SVEUČILIŠTE U SPLITU
FAKULTET GRAĐEVINARSTVA ARHITEKTURE I GEODEZIJE

# DIPLOMSKI RAD

Mario Šarčević

Split, 2015.

**SVEUČILIŠTE U SPLITU**
**FAKULTET GRAĐEVINARSTVA ARHITEKTURE I GEODEZIJE**

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# Projekt nadstrešnice
# Zračna luka Dubrovnik

**Diplomski rad**

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|---|---|
| STUDIJ: | **DIPLOMSKI SVEUČILIŠNI STUDIJ GRAĐEVINARSTVA** |
| KANDIDAT: | Mario Šarčević |
| BROJ INDEKSA: | 433 |
| KATEDRA: | **Katedra za Metalne i drvene konstrukcije** |
| PREDMET: | Metalne konstrukcije |

# ZADATAK ZA DIPLOMSKI RAD

Tema: Projekt nadstrešnice - Zračna luka Dubrovnik

Opis zadatka: Zadatak diplomskog rada je projektirati nadstrešnicu ispred objekata B i C Zračne luke Dubrovnik. Nadstrešnica pokriva kompletnu prometnu površinu za putnike u dolasku (zgrada B) i putnike u odlasku (zgrada C) i ima tlocrtnu površinu od 4500 m² i proteže se cijelom duljinom zgrada „B“ i „C“. Čelična nadstrešnica je zasebna dilatacijska cjelina.
Prometnica pod nadstrešnicom se sastoji od prometnih traka širina 3,0 + 4,5 m, otoka, te dviju traka od 3,5 m. Nadstrešnica se mora moći izvoditi u fazama, a konstruktivno je odvojena od ostalih zgrada.

U Splitu, 20. ožujka 2015.

Voditelj Diplomskog rada:
Prof. dr. sc. Bernardin Peroš

Predsjednik Povjerenstva
za završne i diplomske ispite:
Prof. dr. sc. Ivica Boko

# Projekt nadstrešnice – Zračna luka Dubrovnik


***Sažetak:***

Prema zadanim arhitektonskim podlogama, napravljen je projekt konstrukcije čelične nadstrešnice ispred putničkih terminala Zračne luke Dubrovnik. Arhitektonskim podlogama su bile zadane visinske kote i oblik obloge nadstrešnice kao i tlocrtna dispozicija i oblik stupova. Na temelju zadanih gabarita, napravljen je prostorni proračunski model konstrukcije na kojemu je izvršeno dimenzioniranje svih nosivih elemenata. Nakon toga je napravljeno oblikovanje i proračun priključaka, te je izrađena radionička dokumentacija pojedinih elemenata pomoću računalnog programa *Autocad Structural Detailing*.
Na kraju su dati iskazi materijala pojedinih elemenata i ukupne količine materijala potrebne za izgradnju predmetne konstrukcije.



***Ključne riječi:***

Zračna luka Dubrovnik, nadstrešnica, čelična konstrukcija, priključci, nacrti


# The Project of Canopy – Dubrovnik Airport


***Abstract:***

Based on architectural drawings, was made a steel construction project for canopy in front of the passenger terminal of Dubrovnik airport. Height of the roof, the shape of canopy, ground disposition and shape of the columns was defined with the architectural drawings. Based on given dimensions, a designing model was made on which was autodesign for all support elements performed. Design of joints was made and workshop drawings for particular elements with the software *Autocad Structural Detailing*.
At the end, the bill of material for particular elements was given and also a total quantity of material needed to build present construction.



***Keywords:***

Dubrovnik Airport, Canopy, Steel Construction, Joints, Drawings

## ***Zahvale:***

Zahvaljujem svom mentoru, prof. dr. sc. Bernardinu Perošu na ukazanom povjerenju i pruženoj pomoći tijekom izrade diplomskog rada.

Zahvaljujem se Davidu Kuzmaniću, direktoru tvrtke *Kuzmanić&Šimunović Projekt* , kao i svim zaposlenicima iste tvrtke na pruženoj pomoći i savjetima tijekom izrade diplomskog rada.

Od srca zahvaljujem svojoj obitelji na bezuvjetnoj pruženoj potpori tijekom studija, a posebno roditelima Zvonimiru i Janji.

**SADRŽAJ:**

# 1. UVOD

## 1.1. OPĆENITO

Investitor Zračna luka Dubrovnik Ćilipi – Konavle na postojećoj lokaciji zračne luke rekonstruira i nadograđuje Pristanišnu zgradu a u sklopu nje i zgradu „C“ – putnički terminal, kao i južnu nadstešnicu koja je obuhvaćena ovim projektom.
Predmet ovog projekta je izrada glavnog projekta i izvedbenog projekta nosivih konstrukcija: Južne nadstrešnice.

U ovoj knjizi, prikazan je cjeloviti dokaz nosivosti i stabilnosti građevine u skladu s Tehničkim propisom za čelične konstrukcije (NN 112/08, NN125/10, NN73/12 i NN136/12) i Tehničkim propisom za betonske konstrukcije (NN 139/09, NN14/10, NN125/10 i NN136/12).

## 1.2. LOKACIJA

Kao što je gore navedeno, novoprojektirana zgrada „C“ bit će locirana na lokaciji zračne luke Dubrovnik na k.č. 2361/1 k.o. Močići, općina Konavle, na mjestu stare uklonjene zgrade „C“.

Za lokaciju građevine odabrano je da se nalazi u II. području opterećenja vjetrom ($v_{ref,0}$ = 30m/s) prema HRN EN 1991-1-4:2005, području C opterećenja snijegom s krovom na otprilike 175 m n.m. ($s_k$ = 0,80 kN/m$^2$), prema HRN EN 1991-1-3:2005, te sa potresom intenziteta ($a_g$ = 2,8 m/s$^2$) očitanom na seizmološkoj karti za mikrolokaciju zračne luke, prema HRN EN 1998-1:2011/NA:2011.

Građevina će biti locirana na stabiliziranom autohtonom tlu relativno dobre nosivosti na što ukazuju svi podaci iz geomehaničkih elaborata, koji su citirani u nastavku.

## 1.3. TEMELJENJE GRAĐEVINE

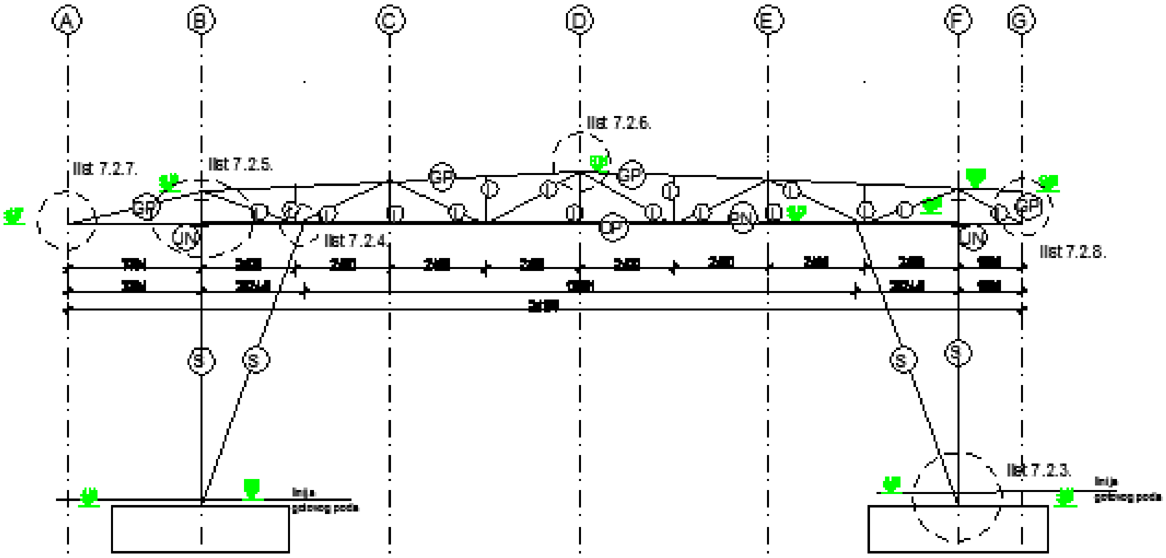
Detaljan opis svojstava tla na lokaciji građevine dan je u geotehničkim elaboratima koje je izradio Conex-ST d.o.o. iz Splita kojima je određeno dopušteno naprezanje na kontaktu temelj/tlo ispod jače opterećenih temelja samaca od $\delta_{dop}$ = 500 kPa. Prije početka (ili u tijeku ukoliko se tlo pokaže lošijim od predviđenog) iskopa predlaže se izvedba prospektorskih i sondažnih bušotina ispod svakog jače opterećenog temelja (svi temelji samci). Ukoliko se na pojedinim mjestima pojavi tlo manje nosivosti predlaže se iskop istog te zamjena tucanikom ili mršavim betonom prema prijedlogu geomehaničara i uz odobrenje nadzornog inženjera.

## 2. TEHNIČKI OPIS

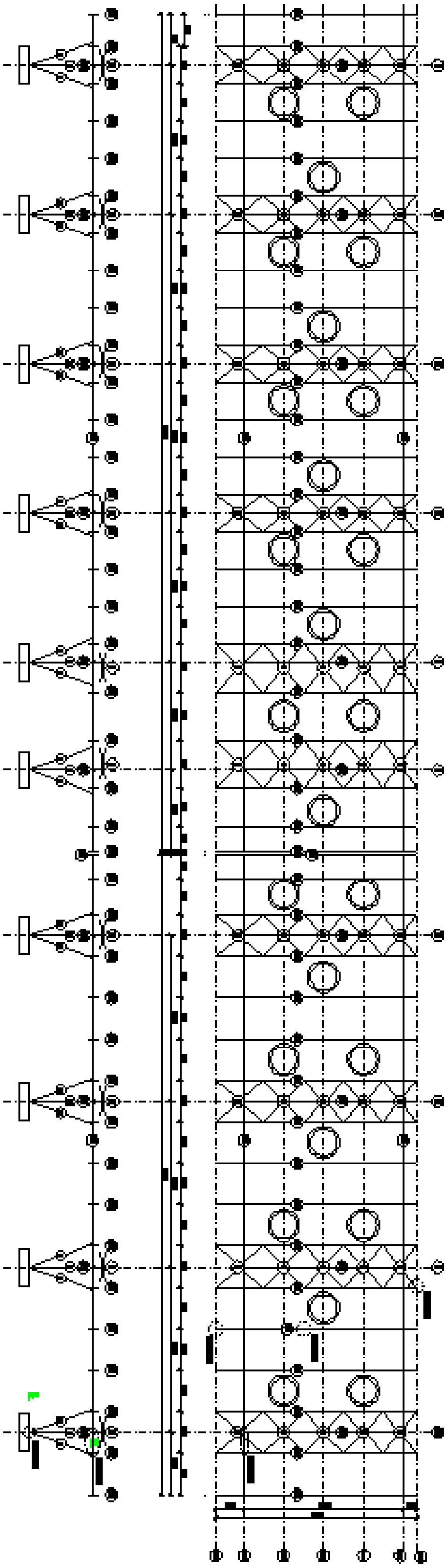
## 2.1. UVOD

Programski zadatak je dizajnirati nadstrešnicu ispred objekata B i C. Nadstrešnica pokriva kompletnu prometnu površinu za putnike u dolasku (zgrada B) i putnike u odlasku (zgrada C) i ima tlocrtnu površinu od 4500 m² (dilatacija B= 2000 m² , dilatacija C= 2500 m²). Čelična konstrukcija južne nadstrešnice proteže se cijelom duljinom zgrade „B“ i cijelom duljinom zgrade „C“, te je uzdužno prepuštena izvan njenog gabarita za otprilike 10.0 m prema istoku iza osi 9 zgrade „C“, te otprilike 9.0 m prema zapadu iza osi 1 zgrade „B“. Čelična nadstrešnica je zasebna dilatacijska cjelina neovisna o zgradi „B“ i „C“. Nadstrešnica je tlocrtnih dimenzija otprilike 180 (m) x 25 (m). Čini ju nosivi sustav poprečno postavljenih rešetkastih nosača na međusobnom razmaku od 3,0 (m) do 6,0 (m).

Prometnica pod nadstrešnicom se sastoji od prometnih traka širina 3,0 + 4,5 m, otoka, te dviju traka od 3,5 m. Nadstrešnica se mora moći izvoditi u fazama, a konstruktivno je odvojena od ostalih zgrada. Dispozicija nadstrešnice prikazana je na slici 2.1. i slici 2.2.




***Slika 2.1***: Poprečna dispozicija nadstrešnice



***Slika 2.2***: Uzdužna dispozicija nadstrešnice

## 2.2. KONSTRUKTIVNI SUSTAV

Osnovna konstrukcija nadstrešnice sastoji iz krutih uzdužnih greda na koje se priključuju kosi pendl stupovi (po dva na uzdužnu prečku i jedan na poprečnu na svakom stupnom mjestu).
Razmaci glavnih nosivih okvira su različiti i iznose od cca 18,0 do 20,0 m (zbog usklađenja rastera sa zgradama B i C, a poprečni rasponi glavnih nosivih okvira su 19,2 m.
Trodijelni stupovi su zglobno vezani za temelje samce i sastoje se od cijevnih profila, visine oko 7.8 m. Iz svakog temelja se iz jedne točke uzdižu tri okrugla stupa presjeka Ø278/8, pod kutom od 20° koji se spajaju na glavni uzdužni nosač presjeka HE 700 A u koje je upeto oslonjen glavni poprečni rešetkasti nosač u poprečnom smjeru nadstrešnice. Glavni uzdužni nosač je u osima glavnih nosivih okvira poprečno povezan u roštiljni sustav preko grede HE 300 A profila.
Limena obloga gornje i donje površine nadstrešnice osigurava se preko sekundarnih elemenata prihvaćenih za poprečbne rešetkaste nosače koji se oslanjaju na uzdužni nosač na razmacima od cca 3,0 - 6,0 m. Pojasevi rešetkastih nosača su su iz profila 140/140, a ispuna od 90/90 profila. Uzdužne veze rešetki i stabilizacija se osigurava preko trapeznog lima na gornjem pojasu i spregova iz punih kružnih profila, promjera Ø16.
U limenoj krovnoj i stropnoj oblozi projektirani su okrugli svjetlarnici (26 komada) za koje je predviđena posebna sekundarna konstrukcija.

## 2.3. MATERIJALI OBLOGE

Pokrov je izveden u dvostranom padu prema olucima dimenzije 45 x 20/15. Izveden je na čeličnom rebrastom limu koji služi i kao poprečna ukruta i podkonstrukcija. Na lim dolaze ploče od mineralne vune debljine 10 cm, a završni materijal je aluminijski lim s preklopima u smjeru okomitom na oluke. Lim je pričvršćen preko klipova, kao sustav KALZIP.
Vidljivi dijelovi nadstrešnice (pogled, zabati i gornji dio „kljuna“ s južne strane do oluka izvedeni su od ravnih aluminijskih ploča na podkonstrukciji od U-profila sa što manjim utorom. Debljina lima je 3 mm. Ploče prema detaljnom izvedbenom projektu.
Sam zaobljeni detalj „kljuna“ na južnoj strani izveden je od inox lima u čitavoj duljini.

## 2.4. TEMELJI

Južna nadstrešnica temeljiti će se na posebnim temeljnim stopama, tlocrtnih dimenzija 4,5 (m) x 4,5 (m), visine temeljne stope 1,5 (m) iz razloga da velika težina betonske stope bude u stanju oduprijeti se djelovanju vlačne reakcije uslijed djelovanja odižućeg vjetra.

## 2.5. UTJECAJ NA SUSJEDNE GRAĐEVINE

U polju 8* – 9* s južne i zapadne strane, kao i iza osi 9 na istoku, te uz os C' na sjeveru, temelji građevine će se izvoditi neposredno uz temelje postojećih konstrukcija. Prilikom obavljanja radova na iskopima za temelje potreban je pojačan nadzor da se ne ugrozi stabilnost kosine uz postojeće objekte. Projektom je predviđeno da se novi temelji dovoljno udalje od zidova postojećih građevina zgrade B, tunela T tako da se prilikom obavljanja radova na iskopima ne zadire u temelje postojećih građevina.
S obzirom na karakteristike temeljnog tla, ne očekuje se izraženije dodatno slijeganje tla uslijed dodatnog opterećenja od nove konstrukcije, pa se utjecaj na susjednu građevinu u tom smislu može se zanemariti.

## 2.6. OPTEREĆENJA

Vrijednosti za proračun opterećenja čelične konstrukcije uzete su prema HRN EN 1991 i HRN EN 1998.

Proračunom čeličnih konstrukcija su obuhvaćena sljedeća opterećenja:
-opterećenje vlastitom težinom
-dodatno stalno opterećenje
-opterećenje vjetrom
-opterećenje uslijed promjene temperature
-opterećenje uslijed djelovanja potresa

## 2.7. PRORAČUN I DIMENZIONIRANJE

Proračuni su provedeni na prostornim linearno elastičnim KE modelima, programskim paketom Scia Engineer 2015, a dimenzioniranje prema normama na koje se pozivaju Tehnički propis za čelične konstrukcije (NN 112/08, 125/10, 73/12 i NN136/12) i Tehnički propis za betonske konstrukcije (NN 139/09, 14/10, 125/10 i NN136/12) i to prema „eurocode“ pravilima.

## 2.8. GRADIVA – OSNOVNI MATERIJAL

Čelični materijal za sve nosive elemente predviđen je iz S235J2. Sav okrugli čelik (sidra i zatege) predviđa se iz S355J2 kako za unutarnje, tako i za vanjske elemente. Svi ostali elementi se predviđaju iz S235J2.
Svi čelični profili predviđaju se kao toplovaljani. Nije dopuštena uporaba hladnovaljanih profila.

## 2.9. VAROVI

Varovi specijalne kvalitete se primjenjuju na dijelovima građevine gdje se pojavljuju sučeoni zavari. Sučeone zavare je potrebno sve ispitati (kontrola 80% ultrazvukom ili sličnom metodom)

Varovi I kvalitete (kontrola 20% ultrazvukom ili sličnom metodom)
varovi cijevi rešetke
varovi pločica na koje se spajaju stupovi.

Svi ostali varovi izvest će se kao varovi II kvalitete.

Konstrukcija je pretežno izvedena kao zavarena, a njeni sastavni dijelovi se spajaju montažno na gradilištu vijcima.

## 2.10. VIJCI

Svi vijčani spojevi su montažnog karaktera i izvesti će vijcima klase čvrstoće 10.9, osim ako je drugačije naznačeno na nacrtima.

## 2.11. ZAŠTITA ČELIČNE KONSTRUKCIJE

Zbog važnosti građevine, ovdje se propisuje najviši zahtjev trajnosti sustava antikorozivne zaštite prema HRN EN ISO 12944-1:1998 i to „High durability - more than 15 years". U smislu agresivnosti sredine propisuje se „C2 low" zahtjev za zaštitu svih čeličnih konstrukcija, prema tablici 1 iz HRN EN ISO 12944-2:1998.
Prije aplikacije antikorozivne zaštitie, metalna podloga mora biti očišćena u stupnju Sa 2.5 (pjeskarenje), prema ISO 8501-1.
U normi HRN EN ISO 12944 navode se uvjeti (tablično) koje sustavi u smislu odabira materijala, broja i deblijna slojeva premaza moraju zadovoljiti. Svaki proizvođač sredstva i izvođač radova premazivanja mora dokazati da odabrani sustav udovoljava gore postavljenim zahtjevima od strane projektanta konstrukcija.

U poglavlju „uvjeti održavanja građevine" koje se nalazi u sklopu „završnog izvješća izvođača radova" potrebno je navesti da je obnova antikorozivna premaza obavezna najmanje svakih 15 godina. U tom istom izvješću potrebno je navesti koji sustav premaza se koristio, u kojem broju i debljinama slojeva.

Gdje je to regulirano „glavnim arhitektonskim projektom" i „projektom zaštite od požara", protupožarna zaštita odgovarajuće klase izvest će se sustavom koji se sastoji od temeljnog premaza, debeloslojnog premaza za protupožarnu zaštitu i završnog premaza ili temeljnog premaza i završnog premaza s odgovarajućim obložnim protupožarnim sustavom.

Propisuje se stalna kontrola procesa izvedbe antikorozivnog premaza, od pripreme podloge, uvjeta prostoru za obavljanje ovih radova, do aplikacije odabranog sustava zaštite na elemente konstrukcije. O svim ovim postupcima izvođač je obavezan voditi dnevnik za dio izvedbe u radionici i popravke nakon montaže. U dnevnik je potrebno evidentirati sva oštećenja sustava prilikom transporta i montaže, kao i mjere koje su poduzete u otklanjanju tih nedostataka.

Zaštita premazima obavlja se u svrhu spriječavanja da kisik i vlaga dođu u dodir s čelikom. Premazivanje se obično vrši bojanjem u dva sloja: osnovni premaz i zaštitni premaz. Osnovni premaz neposredno štiti čelik, a potrebno je da bude izrađen od tvari koje nisu štetne po ljudsko zdravlje. Zaštitni sloj služi za zaštitu osnovog premaza.

Prerano propadanje konstrukcije najčešće nastaje usljed loših detalja u konstrukciji (nepristupačna mijesta za bojenje, mijesta gdje se zadržava voda, oštri bridovi gdje se nemože nanijeti zahtjevana debljina premaza i sl.) koje treba nastojati izbjegavati.

Sistem zaštite bojenjem sastoji se iz:
- Priprema površine – trajnost premaza ovisi o prionjivosti boje za metalnu površinu, što ovisi o čistoći površine prije bojanja. Čiščenje se vrši četkama, pijeskarenjem, plamenikom ili kemijskim sredstvima.
- Nanošenje boje – bojenje se vrši četkom , valjkom ili prskanjem. Treba paziti na ograničenja za pojedine boje. Broj slojeva premaza obično se sastoji od dva a specifično od četiri ili više slojeva. Novi premaz može se vršiti tek kad je prethodni potpuno suh. Debljini premaza potrebno je posvetiti posebnu pažnju. Općenito, deblji premaz povećava trajnost zaštite. Ukupna debljina suhih premaza treba se kretati između 200-400 μm.

Dobro izvedeni premazi traju:
- do 30 godina u zatvorenoj prostoriji
- do 20 godina kod konstrukcija zaštićenih od kiše
- do 10 godina u prirodi
- 2-3 godine u zagađenom okolišu

Zaštita pocinčavanjem podrazumijeva vrste zaštite koje se ostvaruju nanošenjem prevlake cinka i po toplom postupku. Mase i debljine prevlaka cinka za pojedine elemente određene su prema Pravilniku o tehničkim mjerama i uvjetima za zaštitu čeličnih konstrukcija od korozije i ne mogu biti manje od 500g/m2 elementa debljine 5 mm. Sve čelične konstrukcije prethodno treba odmastiti, očistiti razblaženom otopinom klorovodične kiseline te isprati hladnom vodom. Neposredno prije pocinčavanja čelična konstrukcija se stavlja u taljevinu ili otopinu za flusiranje.

Toplo pocinčavanje se izvodi stavljanjem tekućine u rastopljeni cink. Cink mora biti kvaliteta Zn 97,5 do Zn 99,5 prema HRN EN ISO 14713:2001. Prevlaka cinka dobivena toplim postupkom mora biti homogena i mora prekrivati osnovicu. Prevlaka cinka mora čvrsto prianjati za čeličnu površinu i ne smije se ljuštiti niti pucati pri uporabi. Prije montaže potrebno je izvršiti kontrolu prevlake cinka prema HRN C.A1. 558, odnosno mase prevlake cinka prema HRN A6.021.

## 2.12. GRADIVA – ARMIRANO-BETONSKA KONSTRUKCIJA

Sva potrebna gradiva, te njihovi sastojci, trebaju udovoljavati zahtjevima važećih propisa, normi i pravila struke. Ukratko će se navesti osnovna svojstva i zahtjevi na osnovna gradiva (beton, betonski čelik) za glavne konstruktivne elemente.
Predviđena klasa betona za sve armirano-betonske konstrukcije je C 30/37.
Sav betonski čelik predviđa se iz čelika B500B, u svemu prema serijama normi HRN 1130-1:2008 i HRN EN 10080:2005.

## 2.13. PRIMJENJENI PROPISI

U ovoj knjizi, prikazan je cjelovit dokaz nosivosti i stabilnosti građevine u skladu s Tehničkim propisom za čelične konstrukcije (NN 112/08, 125/10 i 73/12) i Tehničkim propisom za betonske konstrukcije (NN 139/09, 14/10 i 125/10). Zbog usvajanja jednakih proračunskih koncepata prilikom projektiranja čeličnih i armirano-betonskih konstrukcija, dokaz nosivosti i stabilnosti vršen je koristeći se nizom „eurocode“ pravila, a ne pomoću nekih „priznatih tehničkih pravila“.

## 2.14. UTJECAJ OKOLINE I NAMJENE KONSTRUKCIJSKIH ELEMENATA GRAĐEVINE NA KARAKTERISTIKE NOSIVE KONSTRUKCIJE

Obzirom na namjenu građevine i utjecaje okoliša, te odabranu nosivu konstrukciju, možemo kazati da su utjecaji na karakteristike njenih unutarnjih elemenata tijekom vremena zanemarivi kako za pojedine elemente, tako i za konstrukcijske cjeline. U tom smislu potrebni su jedino pravovremeni radovi održavanja u smislu antikorozivnih radnji (redovito obnavljanje antikorozivnih i protupožarnih premaza kod čelika i oštećenih zaštitnih slojeva armature po potrebi).

## 2.15. POSEBNE NAPOMENE

**Iskopi**

Iskop se djelomično vrši neposredno uz postojeće građevine zračne luke. Na svim kontaktima s postojećim građevinama pretpostavlja se da zaštita građevne jame nije potrebna osim na istočnom dijelu prema zgradi G. Kao mjera zaštite susjednih građevina u ovom projektu je priložen prijedlog stabilizacije pokosa iskopa. Na geomehaničaru i nadzornom inženjeru je da potvrdi i razradi predloženo rješenje nakon uvida stvarnih prilika na terenu prilikom izvedbe iskopa.

**Temelji**

Svii konstrukcijski elementi temelje se na temeljnim stopama. Preporuča se ispitivanje temeljnog tla ispod svake pojedine stope izvođenjem prospektorske bušotine.

**Čelične konstrukcije**

Zbog relativno visokog stupnja složenosti čeličnih konstrukcija iz ovog projekta, prije izvođenja čeličnih radova, traži se od Izvođača radova izrada elaborata „Tehnologije izvedbe čelične konstrukcije“, koju trebaju odobriti nadzorni inženjer i projektant konstrukcija.

Uz svaki radionički nacrt čelične konstrukcije potrebno je definirati kvalitetu spojnih sredstava (vijaka). Ovdje se posebno skreće pažnja na sidrene vijke koji osiguravpvezanos cielkostrukcij s temljima, a samim time i sa temeljnim tlom.

## 2.16. IZVOĐENJE KONSTRUKCIJE – OPĆE NAPOMENE

Predmetni je projekt izrađen sukladno Zakonu o prostornom uređenju i gradnji (NN 76/07, NN 38/09, NN 55/11, NN 90/11 i 55/12).

Sve radove trebaju obavljati za to stručno osposobljene osobe, uz stalni stručni nadzor, konstrukterski projektantski nadzor, te nadzor od strane geomehaničara prilikom radova iskopa, i temeljenja građevine. Prije prelaska na iduću fazu radova, nužno je odobrenje nadzornog inženjera. Za svako odstupanje od projekta, te u slučaju nepredviđenih okolnosti, potrebna je konzultacija i odobrenje projektanta. Izvoditelj je dužan u potpunosti poštivati sve mjere osiguranja i kontrole kvalitete. Svi upotrijebljeni materijali i svi izvedeni radovi trebaju udovoljavati zahtjevima važećih normi, propisa i pravila struke.

## 2.17. ISKOLČENJE I ZAHTIJEVANA GEOMETRIJA

Od faze iskolčenja građevine, preko svih faza izgradnje, do završetka građevine, nužan je stalni geodetski nadzor.
Tijekom građenja vršiti stalnu kontrolu iskolčenja i druge geometrije svih elemenata, kontrolu osiguranja svih točaka, kontrolu repera i poligonih točaka.

## 2.18. IZVOĐENJE ČELIČNE KONSTRUKCIJE

Čelična konstrukcija izvesti će se prema Izvedbenom projektu čeličnih konstrukcija, koji će biti izrađen u skladu s ovim Glavnim projektom čeličnih konstrukcija, i u skladu sa svim odredbama priloga „I“ Tehničkog propisa za čelične konstrukcije (TPČK) NN 112/08 , NN125/10, NN73/12 i NN136/12 . U slučaju eventualne neuskađenosti potrebno je bez odgode konzultirati projektanta konstrukcija. Elementi čelične konstrukcije proizvesti će se u radionici prema izvedbenim nacrtima iz izvedbenog projekta u cjelinama, kao predgotovljeni elementi, pod uvjetima kako to predviđa Izvedbeni projekt. Na gradilištu se previđa montaža predgovljenih elemenata, prema detaljima iz izvedbenog projekta. Predgovotvljeni elementi moraju biti proizvedeni, dopremljeni i ugrađeni u skladu s odredbama priloga „F“ TPČK NN 112/08, NN125/10, NN73/12 i NN136/12.
Posebnu pažnju kod izrade čelične konstrukcije posvetiti zavarivanju osnovnih struktura, čišćenju podloge, protupožarnoj i korozivnoj zaštiti.

## 2.19. KONTROLNI POSTUPCI PRI IZVOĐENJU ČELIČNIH KONSTRUKCIJA

**Općenito**

Prilikom radova u radionici, tokom montaže i prije puštanja konstrukcije u upotrebu potrebno je vršiti stalne kontrole:

- kontrole kvalitete materijala
- kontrole izrade konstrukcija

Sva ispitivanja za dokazivanje kvalitete materijala i izrade konstrukcija potrebno je povjeriti ovlaštenoj osobi za takva ispitivanja.

**Kontrola materijala**

Sav upotrijebljeni materijal mora udovoljavati uvjetima iz TPČK i normi na koje se TPČK poziva u prilozima „A“, „B“, „C“, „D“ i „E“.

Materijal za čelične konstrukcije mora biti pažljivo pregledan i ispitan kod nabave i prije preuzimanja, po svim zahtjevima u pogledu čvrstoće, granice razvlačenja, kemijskog sastava, žilavosti, zavarljivosti, tolerancija mjera i dimenzija, strukture, a sve u skladu sa normama iz navedenih priloga TPČK.

Vijci, podložne pločice, matice i tome slični materijali moraju u pogledu kvalitete i dimenzija biti u skladu sa specifikacijama iz ovog projekta i normama iz navedenih priloga TPČK.

Ovi materijali moraju biti ispitani i posjedovati valjanu ispravu o sukladnosti, a ukoliko nisu obaveza je nadzornog inženjera da ih ukloni i zamjeni odgovarajućima. Sve gore navedeno vrijedi za elektrode i žice za zavarivanje.

Nadzorni inženjer mora imati uvid u svaku fazu izrade i montaže, kako na gradilištu tako i u radionici.

**Kontrola izrade**

Svi elementi konstrukcije, pojedinačno i u cjelini, moraju biti izvedeni oblikom i dimenzijama po ovom projektu.

Izvedba mora biti u skladu s normama koje se odnose na za toleranciju mjera i oblika kod nosivih čeličnih konstrukcija u prilozima iz TPČK.

**Kontrola varova**

Kontrola kvalitete zavarenih spojeva mora pokriti sve faze izrade konstrukcije tj. preuzimanje materijala, kontrolu i pripremu elektroda, izvođenje te pregled zavarenih spojeva nakon varenja i obrade. O kontroli u svim fazama treba voditi dnevnik zavarivanja. Kontrolu mora vršiti za to kvalificirana i ovlaštena osoba.

Svi varovi ispituju se vizualno, a po dovršenju vara nakon obrade vara i čišćenja, utvrđuju se pukotine i druge nepravilnosti. Nepravilni varovi ne smiju se dodatno navarivati već ih je potrebno ukloniti i ponovno izvesti.

Ovim projektom predviđa se obaveza ispitivanja čeličnih zavarenih spojeva od strane ovlaštene osobe prema „Plan ispitivanja zavarenih spojeva“, koji predlaže Izvođač, a odobravaju nadzorni inženjer i projektant konstrukcija i to:

Varovi specijalne kvalitete: (kontrola: 80% ultrazvučno ili sličnom metodom, 20% radiografsko snimanje)

- sučeoni varovi nastavaka vlačnih lamela glavnih nosača krovne konstrukcije
- sučeoni nastavci glavnih nosača svih mostova

Varovi I kvalitete (kontrola 20% ultrazvukom ili sličnom metodom)

- ostali varovi glavnog nosača krovne konstrukcije
- ostali varovi konstrukcija svih mostova
- varovi konstrukcija tetiva čeličnih stubišta

Svi ostali su varovi II kvalitete (vizualni pregled).

**Kontrola vijčanih spojeva**

Kontrola vijčanih spojeva podrazumijeva kontrolu klase vijaka, dimenzija vijaka, te eventualno sila prednapinjanja gdje su prednapeti vijci projektom predviđeni. Glave vijaka i matice moraju uredno nalijegati cijelom svojom površinom. Kod kosih spojeva potrebno je ugraditi klinaste podložne pločice, a sve prema normama koje su citirane prilogom „B“ TPČK.

**Izrada i montaža konstrukcije**

Ovim projektom određena je vrsta i kvaliteta materijala za izradu konstrukcija.

Izvođač radova dužan je, prije izvođenja, predočiti nadzornom inženjeru:

- plan zavarivanja sa rasporedom i redoslijedom zavarivanja
- plan montaže sa načinom i redoslijedom montaže
- isprave o sukladnosti materijala za izradu konstrukcije
- isprave o sukladnosti spojnih sredstava (vijčane robe, elektroda i dr.)
- ateste varioca koji će raditi na izradi konstrukcije

Za vrijeme izrade konstrukcije izvođač je dužan voditi :

- radionički dnevnik (proizvodnja nosača, izvedba antikorozivne zaštite)
- dnevnik zavarivanja
- dnevnik montaže

Svi sastavni dijelovi konstrukcije moraju biti izrađeni prema radioničkim nacrtima u skladu s Glavnim i Izvedbenim projektom čeličnih konstrukcija. Sve izmjene i dopune moraju se evidentirati, a za njih je potrebno ishoditi dokaze nosivosti i stabilnosti i suglasnost projektanta.

Svi varovi i montažni spojevi moraju se očistiti i ispraviti nepravilno izvedeni dijelovi, te je tek nakon obavljenih kontrola, dopušteno izvoditi korozivnu i protupožarnu zaštitu.

Korozivna i protupožarna zaštita

Čelične konstrukcije korozivno i protupožarno će se štititi premazivanjem.

Zbog važnosti građevine, ovdje se propisuje najviši zahtjev trajnosti sustava antikorozivne zaštite prema HRN EN ISO 12944-1:1998 i to „High durability - more than 15 years“.

U smislu agresivnosti sredine propisuje se „C1 low“ zahtjev za zaštitu svih unutrašnjih čeličnih konstrukcija, a „C3 medium“ zahtjev za zaštitu vanjskih elemenata konstrukcija (čelične konstrukcije aviomostova i južne nadstrešnice) prema tablici 1 iz HRN EN ISO 12944-2:1998.

Prije aplikacije korozivne zaštitie, metalna podloga mora biti očišćena u stupnju Sa 2.5 (pjeskarenje), prema ISO 8501-1.

U normi HRN EN ISO 12944 navode se uvjeti (tablično) koje sustavi u smislu odabira materijala, broja i debljina slojeva premaza moraju zadovoljiti. Svaki proizvođač sredstva i izvođač radova premazivanja mora dokazati da odabrani sustav udovoljava gore postavljenim zahtjevima od strane projektanta konstrukcija.

Gdje je to regulirano „glavnim arhitektonskim projektom“ i „projektom zaštite od požara“, protupožarna zaštita odgovarajuće klase izvest će se sustavom koji se sastoji od temeljnog premaza, debeloslojnog premaza za protupožarnu zaštitu i završnog premaza ili temeljnog premaza i završnog premaza s odgovarajućim obložnim protupožarnim sustavom.

U poglavlju „Uvjeti održavanja građevine“ koje se nalazi u sklopu „završnog izvješća izvođača radova“ potrebno je navesti da je obnova antikorozivna premaza obavezna najmanje svakih 15 godina, a protupožarnog svakih 5 godina. U tom istom izvješću potrebno je navesti koji sustav premaza se koristio, u kojem broju i debljinama slojeva.

Propisuje se stalna kontrola procesa izvedbe antikorozivnog i protupožarnog premaza, od pripreme podloge, uvjeta u prostoru za obavljanje ovih radova, do aplikacije odabranog sustava zaštite na elemente konstrukcije. O svim ovim postupcima izvođač je obavezan voditi dnevnik za dio izvedbe u radionici i popravke nakon montaže. U dnevnik je potrebno evidentirati sva oštećenja sustava prilikom transporta i montaže, kao i mjere koje su poduzete u otklanjanju tih nedostataka.

**Obračun čelične konstrukcije**

Obračun radova na izradi i montaži konstrukcije utvrđuje se ugovorom između naručioca i izvođača radova.

Ako ugovorom nije drukčije definirano dijelovi čelične konstrukcije čija je izmjerena težina veća od računske težine, i to za više od 6% za dijelove iz topljenog čelika, odnosno za više od 10% za dijelove od lijevanog čelika, kao i svi dijelovi čija je izmjerena težina manja od računske za više od 2% mogu se odbaciti.

Za one elemente koji nisu standardizirani u pogledu težine, uzimaju se slijedeće vrijednosti:

1) 8000 kg/$m^3$ za čelične limove i plosnate čelike

2) 7850 kg/$m^3$ za lijevano željezo

Na težinu materijala iz projekta dodaju se težine spojnih sredstava i to :

1) 3% za obične vijke

2) 1,5% za zavarenu konstrukciju

3) 2% za više različitih spojnih sredstava

Ukoliko dodatak za spojna sredstva nije obračunat u specifikaciji iz projekta, smatra se obračunatim u jediničnoj cijeni.
Ukoliko projektom ili ugovorom između investitora i izvođača nije drukčije ugovoreno, antikorozivna zaštita obračunata je u jediničnoj cijeni izrade i montaže konstrukcije.

## 2.20. NAČIN ODRŽAVANJA I PROJEKTIRANI VIJEK UPORABE GRAĐEVINE

Radnje u okviru održavanja čeličnih i betonskih konstrukcija treba provoditi prema odredbama TEHNIČKOG PROPISA ZA ČELIČNE KONSTRUKCIJE NN112/08 i NN125/10, NN73/12 i NN136/12, te TEHNIČKOG PROPISA ZA BETONSKE KONSTRUKCIJE NN139/09, NN14/10, NN125/10 i NN 136/12. Izjavu o izvedenim radovima i uvjetima održavanja građevine dužan je prirediti Izvođač u skladu s pozitivnom regulativom RH, tehničkim propisima, normama na koje se oni pozivaju, te Glavnim i Izvedbenim projektom.
Redovite preglede u svrhu održavanja čelične i a-b konstrukcije iz ovog projekta potrebno je provoditi najmanje svakih 5 godina.

Način obavljanja pregleda je slijedeći:

a) vizualni pregled konstrukcija, u kojeg je uključeno utvrđivanje položaja i veličine progiba, pukotina, relativnih pomaka pojedinih elemenata konstrukcije, potencijalnih prodora vode koji dugoročno ugrožavaju pojedine elemente konstrukcija, te drugih oštećenja kao što su naknadno izvedeni proboji i intervencije u nekim elementima konstrukcija i slično, a koji su bitni za očuvanje mehaničke otpornosti i stabilnosti građevine
b) utvrđivanje stanja zaštitnih slojeva
c) utvrđivanje stanja montažnih nastavaka, spojeva (spojnih sredstava: varova, pločevina, vijaka)
d) utvrđivanje gubitaka inicijalnih sila (minimalna zategnutost vlačnih elemenata, zategnutost vlačnih elemenata kod prednapetih konstrukcija ostakljenja)
e) utvrđivanja stanja korozivne i protupožarne zaštite

Način održavanja:

a) redovito obnavljanje antikorozivnih premaza minimalno svakih 15 godina
b) redovito obnavljanje protupožarnih premaza minimalno svakih 5 godina
c) obnavljanje oštećenih elemenata ab konstrukcije (zaštitnih slojeva armature)

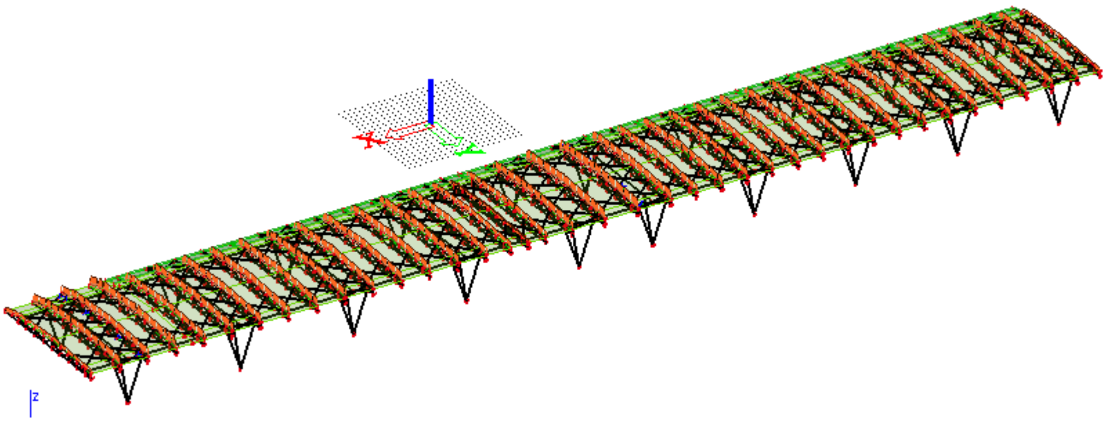
Dokumentaciju o izvršenim pregledima i drugu dokumentaciju o održavanju čelične konstrukcije dužan je trajno čuvati vlasnik građevine. Uporabni vijek predmetnih konstrukcija je najmanje 50 godina.

# 3. ANALIZA OPTEREĆENJA

## 3.1. DODATNO STALNO OPTEREĆENJE (Δg)

- sendvič panel 0,20 kN/m$^2$
- sekundarna konstrukcija + spregovi 0,20 kN/m$^2$
- instalacije 0,10 kN/m$^2$
- opterećenje svjetlarnicima 0,50 kN/m$^2$

Δg = 1,0 kN/m$^2$



***Slika 3.1***: Prikaz dodatnog stalnog opterećenja na konstrukciju

## 3.2. OPTEREĆENEJ SNIJEGOM (s)

Opterećenje snijegom na krovu

$s = \mu_i \cdot C_e \cdot C_t \cdot s_k$

- $\mu_i$ - koef. oblika za opterećenje snijegom

krov nagiba $\alpha_1 = \alpha_2 \cong 0^\circ \Rightarrow \mu_1 == \mu_2 = 1{,}0$

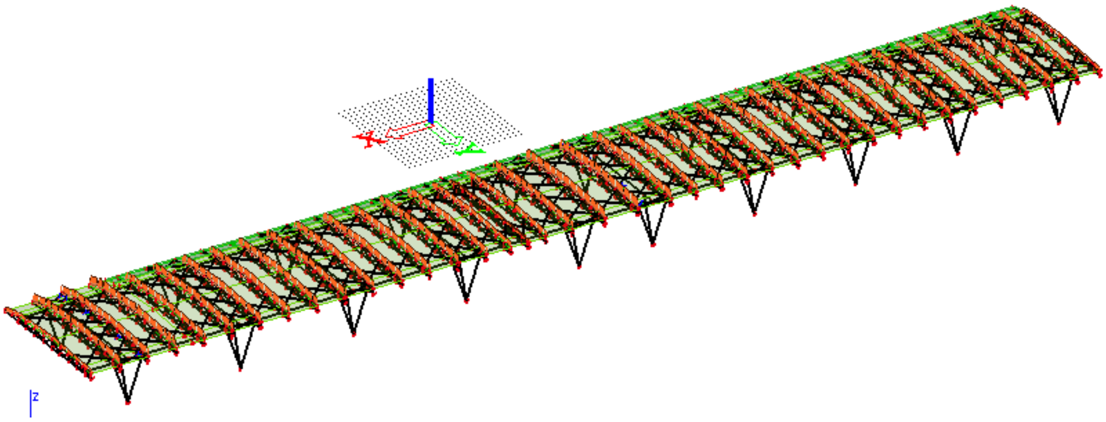
- $s_k$ - karakteristična vrijednost opterećenja na tlu u $(\mathrm{kN/m^2})$

zona Dubrovnik, područje C, nadmorska visina do 200 m n.v. $\Rightarrow s_k = 0{,}8(kN/m^2)$

- $C_e$ - koef. izloženosti $\Rightarrow C_e = 1{,}0$

- $C_t$ - toplinski koef. $\Rightarrow C_t = 1{,}0$

$\Rightarrow s_1 = 1{,}0 \cdot 1{,}0 \cdot 1{,}0 \cdot 0{,}8 = 0{,}8(kN/m^2)$



***Slika 3.2***: Prikaz opterećenja snijegom na konstrukciju

### 3.3. OPTEREĆENJE VJETROM

Opterećenje vjetrom okomito na površinu

$\mathrm{w_e = q_{ref} \cdot c_e(z_e) \cdot c_{pe} - (kN/m^2)}$ - pritisak vjetra na vanjske površine

$q_{ref}$ - poredbeni tlak pri srednjoj brzini vjetra

$c_e(z_e)$, $c_e(z_i)$ - koef. izloženosti koji uzimaju u obzir neravnine terena

$z_e$, $z_i$ - poredbene visine za lokalni ili unutarnji tlak

$c_{pe}$, $c_{pi}$ - koef. vanjskog i unutarnjeg tlaka

- $q_{ref} = \dfrac{\rho}{2} \cdot v_{ref}^2$
- $\rho$ - gustoća zraka
- $v_{ref} = c_{DIR} \cdot c_{TEM} \cdot c_{ALT} \cdot v_{ref,0}$ - poredbena brzina vjetra

$v_{ref,0} = 30(m/s)$ - osnovna poredbena brzina vjetra za II. zonu

$c_{DIR} = 1{,}0$ - koef. smjera vjetra

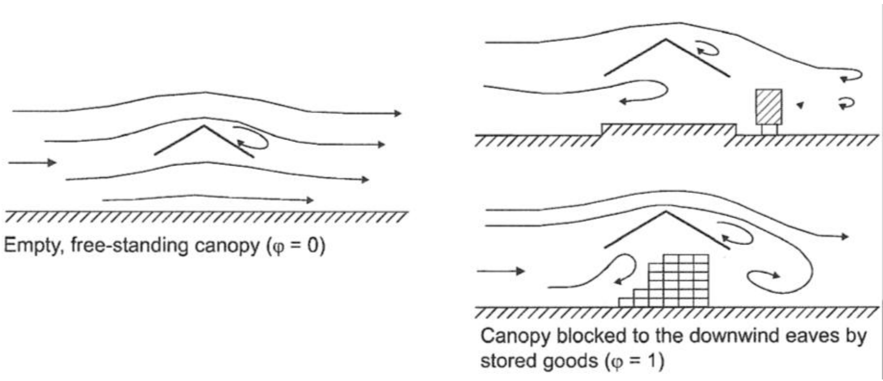
$c_{TEM} = 1{,}0$ - koef. ovisan o godišnjem dobu

$c_{ALT} = 1 + 0{,}001 \cdot a_s = 1 + 0{,}001 \cdot 170 = 1{,}2$ - koef. nadmorske visine,

$a_s$ - nadmorska visina (m)

$\Rightarrow v_{ref} = 1{,}0 \cdot 1{,}0 \cdot 1{,}2 \cdot 30 = 36{,}0(m/s)$

koeficijent zapunjenosti φ=1,0




***Slika 3.3***: Koeficijent zapunjenosti ispod nadstrešnice

zona Dubrovnik; II. kategorija zemljišta;

visina objekta $h \approx 9{,}0(m)\,;v_{ref} = 36{,}0(m/s)$; $\rho = 1{,}25(\mathrm{kg/m^3})$

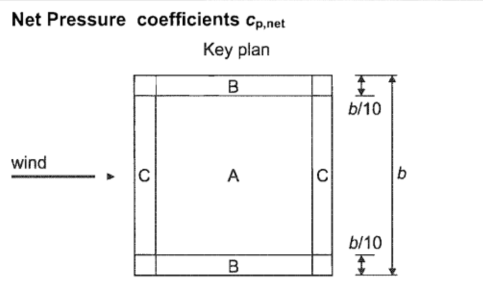
$$\Rightarrow q_{ref} = \frac{1{,}25}{2}\cdot 36{,}0^2 = 450{,}0(N/m^2) = 0{,}45(kN/m^2)$$

$$\Rightarrow c_e(z_e) = c_e(z_i) = 3{,}0$$

Pritisak vjetra na vanjske površine računa se po izrazu:

$$w_e = q_{ref}\cdot c_e(z_e)\cdot c_{pe} = 0{,}45\cdot 3{,}0\cdot c_{pe} = 1{,}35\cdot c_{pe}(kN/m^2)$$

### 3.3.1. Odižući vjetar ($w_d$)




| Roof angle $\alpha$ | Blockage $\varphi$ | Overall Force Coefficients $c_f$ | Zone A | Zone B | Zone C |
|---|---|---|---|---|---|
| 0° | Maximum all $\varphi$ | + 0,2 | + 0,5 | + 1,8 | + 1,1 |
| | Minimum $\varphi$ = 0 | - 0,5 | - 0,6 | - 1,3 | - 1,4 |
| | Minimum $\varphi$ = 1 | - 1,3 | - 1,5 | - 1,8 | - 2,2 |

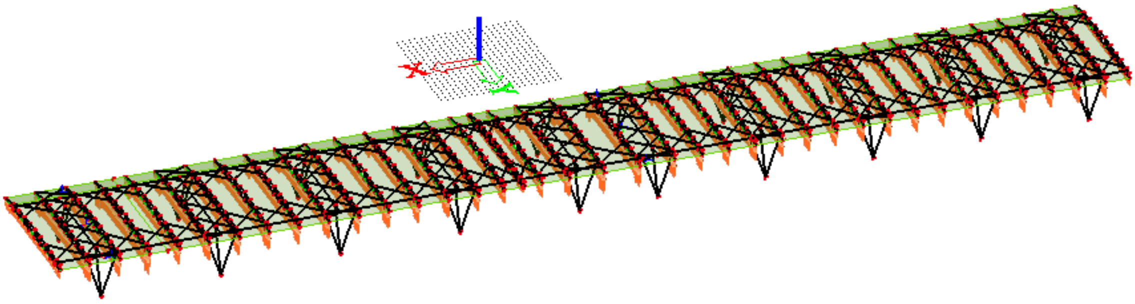
***Slika 3.4***: Koeficijenti pritisaka vjetra na nadstrešnicu prema HRN EN 1991-1-4:2005

- koef. vanjskog tlaka $\alpha_1 = \alpha_2 \cong 0^\circ$

d=25 m; b = 180 m

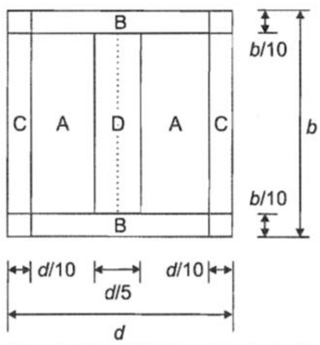
| PODRUČJE | A | B | C |
|---|---|---|---|
| $c_{pe}$ | -1,50 | -1,80 | -2,20 |
| $w_e$ (kN/m$^2$) | -1,95 | -2,34 | -2,86 |

***Tablica 3.1***: Rezultirajuće djelovanje vjetra na konstrukciju po zonama



***Slika 3.5***: Prikaz opterećenja vjetrom odozdo na konstrukciju

### 3.3.2. Vjetar odozgo ($w_g$)




| Roof angle $\alpha$ [°] | Blockage $\varphi$ | Overall Force Coefficient $c_f$ | Net pressure coefficients $c_{p,net}$ Zone A | Zone B | Zone C | Zone D |
|---|---|---|---|---|---|---|
| + 5 | Maximum all $\varphi$ | + 0,3 | + 0,6 | + 1,8 | + 1,3 | + 0,4 |
| | Minimum $\varphi = 0$ | - 0,6 | - 0,6 | - 1,4 | - 1,4 | - 1,1 |
| | Minimum $\varphi = 1$ | - 1,3 | - 1,3 | - 2,0 | - 1,8 | - 1,5 |

***Slika 3.6*** Koeficijenti pritisaka vjetra na nadstrešnicu prema HRN EN 1991-1-4:2005

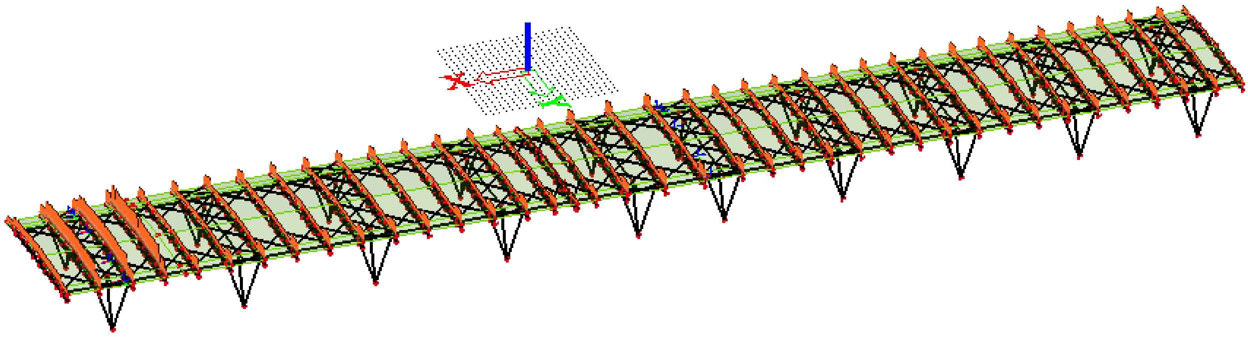
- koef. vanjskog tlaka za krov nagiba $\alpha_1 = \alpha_2 \cong 5^\circ$

d=25 m; b = 180 m

| PODRUČJE | A | B | C |
|---|---|---|---|
| $c_{pe}$ | +0,60 | +1,80 | +1,30 |
| $w_e$ (kN/m$^2$) | +0,78 | +2,34 | +1,69 |

***Tablica 3.2***: Rezultirajuće djelovanje vjetra na konstrukciju po zonama

Područje zone D je uzeto u proračun sa koeficijentima zone C.



***Slika 3.7***: Prikaz opterećenja vjetrom odozgo na konstrukciju

## 3.4. TEMPERATURNO DJELOVANJE (t)

Temperaturno djelovanje se promatra kao linearna promjena temperature cijele konstrukcije odjednom, dok je nelinearna promjena temperature pojedinih djelova konstrukcije zanemarena zbog činjenice da je cijela konstrukcija obložena, tj zatvorena sendvič panelima koji su ispunjeni termoizolacijskim materijalom.

Za proračun temperaturnog djelovanja uzeto je da se montaža obavlja na +10 °C, a mjerodavna maksimalna i minimalna temperatura je uzeta prema HRN EN 1991-1-5:2003

**Tablica NAD.1 – Najviše temperature zraka u hladu u ovisnosti o nadmorskoj visini**

| Nadmorska visina do [m] | I. područje [°C] | II. područje [°C] | III. područje [°C] | IV. područje [°C] |
|---|---|---|---|---|
| 100 | 39 | 38 | 42 | 39 |
| 400 | 36 | 36 | 39 | 39 |
| 800 | 33 | 34 | 36 | 39 |
| 1200 | 30 | 32 | 34 | -- |
| 1600 | 28 | 30 | 31 | -- |

**Tablica NAD.2 – Najniže temperature zraka u hladu u ovisnosti o nadmorskoj visini**

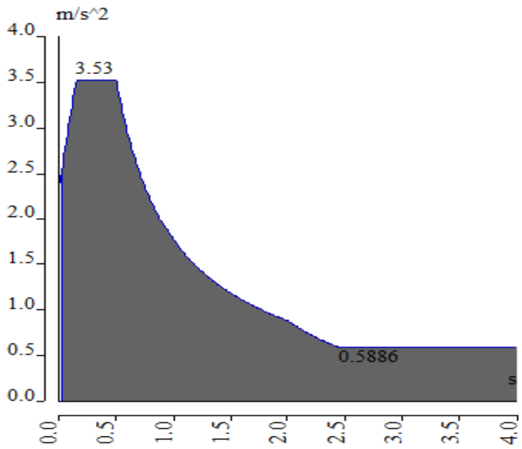
| Nadmorska visina do [m] | I. područje [°C] | II. područje [°C] | III. područje [°C] | IV. područje [°C] | V. područje [°C] |
|---|---|---|---|---|---|
| 100 | -26 | -26 | -17 | -10 | -16 |
| 400 | -23 | -26 | -19 | -13 | -18 |
| 800 | -20 | -26 | -21 | -17 | -19 |
| 1200 | -17 | -26 | -23 | -20 | -21 |
| 1600 | – | -26 | -24 | -24 | -23 |
| >1600 | – | -26 | – | -26 | -24 |

***Tablica 3.3***: Mjerodavne temperature zraka po zonama

Za područje Dubrovnika, uzeto je područje II. za maksimalnu temperaturu $T_{max}$ = +38 °C, a područje IV. za minimalnu temperaturu $T_{min}$ = -10 °C, te tome pripadajuće razlike temperatura $\Delta T_{max}$ = +38-10=+28 °C i $\Delta T_{min}$ = -10-10=-20 °C.

## 3.5. OPTEREĆENJE POTRESOM (e)

Opterećenje potresom je zadano prema seizmološkoj karti Hrvatske za područje Dubrovnika kao vrijednost horizontalnog ubrzanja tla $a_g$= 0,28g. Temeljno tlo na kojemu se građevina nalazi je kategorije A, a faktor ponašanja je uzet q= 2,5 za linearno ponašanje čelične konstrukcije, te je prema tim podacima automatski izrađen proračunski spektar odgovora konstrukcije.




***Slika 3.8***: Proračunski spektar odgovora konstrukcije

Potres je zadan u računalnom programu, te generiran automatski na temelju sudjelujućih masa generiranih iz opterećenja vlastitom težinom i dodatnog stalnog opterećenja.

Na temelju tih ulaznih podataka napravljena je modalna analiza iz koje su dobiveni vlastiti oblici konstrukcije i njima prpadajući periodi sa sudjelujućim masama. Proračunom je obuhvaćeno prvih 50 vlastitih oblika koji skupa obuhvaćaju 91% mase u smijeru osi x, 99% mase u smijeru osi y, te 35% mase u smijeru osi z.

Daljnjim postupkom, računate su rezne sile od potresnog opterećenja, tako da je u analizi potresa iz jednog smijera uzeto da potres djeluje sa 30% svoga intenziteta i u dva ostala otrogonalna smijera.

Modal participation factors

| Mode | Omega [rad/s] | Period [s] | Freq. [Hz] | Wxi / Wxtot | Wyi / Wytot | Wzi / Wztot | Wxi_R / Wxtot_R | Wyi_R / Wytot_R | Wzi_R / Spectral |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 6.8085 | 0.9228 | 1.0836 | 0.0000 | 0.4170 | 0.0000 | 0.0001 | 0.0000 | 0.3443 |
| 2 | 7.2900 | 0.8619 | 1.1602 | 0.0000 | 0.5651 | 0.0000 | 0.0002 | 0.0000 | 0.2889 |
| 3 | 7.9548 | 0.7899 | 1.2660 | 0.0001 | 0.0094 | 0.0000 | 0.0000 | 0.0000 | 0.1448 |
| 4 | 8.0934 | 0.7763 | 1.2881 | 0.0000 | 0.0005 | 0.0000 | 0.0000 | 0.0000 | 0.1972 |
| 5 | 10.9036 | 0.5762 | 1.7354 | 0.0000 | 0.0004 | 0.0000 | 0.0000 | 0.0000 | 0.0007 |
| 6 | 12.4702 | 0.5039 | 1.9847 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0002 |
| 7 | 13.6061 | 0.4618 | 2.1655 | 0.0991 | 0.0000 | 0.0001 | 0.0000 | 0.0000 | 0.0000 |
| 8 | 14.0677 | 0.4466 | 2.2389 | 0.0001 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 9 | 14.8198 | 0.4240 | 2.3586 | 0.0001 | 0.0003 | 0.0000 | 0.0000 | 0.0000 | 0.0027 |
| 10 | 16.4659 | 0.3816 | 2.6206 | 0.2396 | 0.0000 | 0.0013 | 0.0000 | 0.0004 | 0.0000 |
| 11 | 17.8473 | 0.3521 | 2.8405 | 0.0024 | 0.0000 | 0.0000 | 0.0001 | 0.0000 | 0.0012 |
| 12 | 19.4914 | 0.3224 | 3.1022 | 0.2961 | 0.0000 | 0.0027 | 0.0000 | 0.0008 | 0.0000 |
| 13 | 19.6160 | 0.3203 | 3.1220 | 0.0786 | 0.0000 | 0.0007 | 0.0000 | 0.0002 | 0.0000 |
| 14 | 22.1618 | 0.2835 | 3.5272 | 0.0002 | 0.0000 | 0.0001 | 0.0010 | 0.0000 | 0.0030 |
| 15 | 22.7073 | 0.2767 | 3.6140 | 0.0001 | 0.0000 | 0.0241 | 0.0014 | 0.0002 | 0.0000 |
| 16 | 23.2179 | 0.2706 | 3.6953 | 0.0002 | 0.0000 | 0.0213 | 0.0010 | 0.0482 | 0.0000 |
| 17 | 23.3106 | 0.2695 | 3.7100 | 0.0001 | 0.0001 | 0.0007 | 0.0003 | 0.0000 | 0.0011 |
| 18 | 23.4531 | 0.2679 | 3.7327 | 0.0000 | 0.0000 | 0.0001 | 0.0000 | 0.0004 | 0.0000 |
| 19 | 23.4898 | 0.2675 | 3.7385 | 0.0002 | 0.0000 | 0.0000 | 0.0000 | 0.0038 | 0.0000 |
| 20 | 23.5619 | 0.2667 | 3.7500 | 0.0001 | 0.0000 | 0.0675 | 0.0033 | 0.0499 | 0.0000 |
| 21 | 24.3511 | 0.2580 | 3.8756 | 0.0149 | 0.0000 | 0.0364 | 0.0014 | 0.0002 | 0.0000 |
| 22 | 24.3625 | 0.2579 | 3.8774 | 0.0000 | 0.0000 | 0.0003 | 0.0000 | 0.0008 | 0.0000 |
| 23 | 24.4948 | 0.2565 | 3.8985 | 0.0000 | 0.0000 | 0.0003 | 0.0000 | 0.0011 | 0.0000 |
| 24 | 24.5861 | 0.2556 | 3.9130 | 0.0236 | 0.0000 | 0.0008 | 0.0001 | 0.0030 | 0.0000 |
| 25 | 24.6110 | 0.2553 | 3.9170 | 0.0000 | 0.0000 | 0.0031 | 0.0003 | 0.0219 | 0.0000 |
| 26 | 24.6926 | 0.2545 | 3.9299 | 0.0022 | 0.0000 | 0.0525 | 0.0021 | 0.0318 | 0.0000 |
| 27 | 24.8334 | 0.2530 | 3.9524 | 0.0000 | 0.0000 | 0.0033 | 0.0002 | 0.0036 | 0.0000 |
| 28 | 24.8637 | 0.2527 | 3.9572 | 0.0001 | 0.0000 | 0.0001 | 0.0000 | 0.0100 | 0.0000 |
| 29 | 24.8927 | 0.2524 | 3.9618 | 0.0000 | 0.0000 | 0.0948 | 0.0048 | 0.1057 | 0.0000 |
| 30 | 25.1676 | 0.2497 | 4.0056 | 0.0066 | 0.0000 | 0.0018 | 0.0000 | 0.0004 | 0.0000 |
| 31 | 25.2524 | 0.2488 | 4.0190 | 0.0025 | 0.0000 | 0.0112 | 0.0007 | 0.0025 | 0.0000 |
| 32 | 25.3029 | 0.2483 | 4.0271 | 0.0203 | 0.0000 | 0.0046 | 0.0000 | 0.0000 | 0.0000 |
| 33 | 25.5496 | 0.2459 | 4.0663 | 0.0001 | 0.0000 | 0.0000 | 0.0000 | 0.0005 | 0.0000 |
| 34 | 25.6256 | 0.2452 | 4.0784 | 0.0151 | 0.0000 | 0.0048 | 0.0000 | 0.0002 | 0.0000 |
| 35 | 25.7017 | 0.2445 | 4.0906 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0002 | 0.0000 |
| 36 | 25.7659 | 0.2439 | 4.1008 | 0.0096 | 0.0000 | 0.0002 | 0.0000 | 0.0006 | 0.0000 |
| 37 | 25.9865 | 0.2418 | 4.1359 | 0.0019 | 0.0000 | 0.0001 | 0.0000 | 0.0009 | 0.0000 |
| 38 | 25.9893 | 0.2418 | 4.1363 | 0.0101 | 0.0000 | 0.0021 | 0.0002 | 0.0037 | 0.0001 |
| 39 | 26.2335 | 0.2395 | 4.1752 | 0.0002 | 0.0000 | 0.0093 | 0.0007 | 0.0150 | 0.0000 |
| 40 | 26.3902 | 0.2381 | 4.2001 | 0.0028 | 0.0000 | 0.0003 | 0.0000 | 0.0000 | 0.0000 |
| 41 | 26.5413 | 0.2367 | 4.2242 | 0.0005 | 0.0000 | 0.0014 | 0.0005 | 0.0031 | 0.0026 |
| 42 | 26.8143 | 0.2343 | 4.2676 | 0.0142 | 0.0000 | 0.0001 | 0.0008 | 0.0004 | 0.0022 |
| 43 | 26.8650 | 0.2339 | 4.2757 | 0.0008 | 0.0000 | 0.0000 | 0.0000 | 0.0001 | 0.0000 |
| 44 | 27.0368 | 0.2324 | 4.3030 | 0.0014 | 0.0000 | 0.0002 | 0.0001 | 0.0018 | 0.0001 |
| 45 | 27.2431 | 0.2306 | 4.3359 | 0.0010 | 0.0000 | 0.0006 | 0.0000 | 0.0005 | 0.0000 |
| 46 | 27.2516 | 0.2306 | 4.3372 | 0.0012 | 0.0000 | 0.0002 | 0.0001 | 0.0000 | 0.0000 |
| 47 | 27.5044 | 0.2284 | 4.3775 | 0.0019 | 0.0000 | 0.0006 | 0.0001 | 0.0019 | 0.0000 |
| 48 | 27.8478 | 0.2256 | 4.4321 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0001 |
| 49 | 27.9611 | 0.2247 | 4.4501 | 0.0005 | 0.0000 | 0.0002 | 0.0000 | 0.0012 | 0.0000 |
| 50 | 28.4262 | 0.2210 | 4.5242 | 0.0006 | 0.0000 | 0.0005 | 0.0000 | 0.0013 | 0.0000 |
| | | | | 0.9092 | 0.9929 | 0.3482 | 0.0196 | 0.3162 | 0.9895 |

***Tablica 3.4:*** Vlastiti oblici konstrukcije

### 3.6. KOMBINACIJE DJELOVANJA

Prema nabrojenim i prikazanim opterećenjima, zaključeno je da su četiri kombinacije mjerodavne za dimenzioniranje svih elemenata konstrukcije, pa su tako u obzir uzete samo te četiri kombinacije za krajnje granično stanje i te iste četiri za granično stanje uporabe.

**Kombinacije krajnjeg graničnog stanja:**

$GSN_1$ – 1,0 $(g + \Delta g)$ + 1,5 $w_d$

$GSN_2$ – 1,35 $(g + \Delta g)$ + 1,5 $w_g$ + 1,5·0,9 s

$GSN_3$ – 1,0 $(g + \Delta g)$ + 1,0 $e_x$ + 0,3 $e_y$ + 0,3 $e_z$

$GSN_4$ – 1,0 $(g + \Delta g)$ + 0,3 $e_x$ + 1,0 $e_y$ + 0,3 $e_z$

**Kombinacije za granično stanje uporabe:**

$GSU_1$ – 1,0 $(g + \Delta g)$ + 1,0 $w_d$

$GSU_2$ – 1,0 $(g + \Delta g)$ + 1,0 $w_g$ + 1,0·0,9 s

$GSU_3$ – 1,0 $(g + \Delta g)$ + 1,0 $e_x$ + 0,3 $e_y$ + 0,3 $e_z$

$GSU_4$ – 1,0 $(g + \Delta g)$ + 0,3 $e_x$ + 1,0 $e_y$ + 0,3 $e_z$

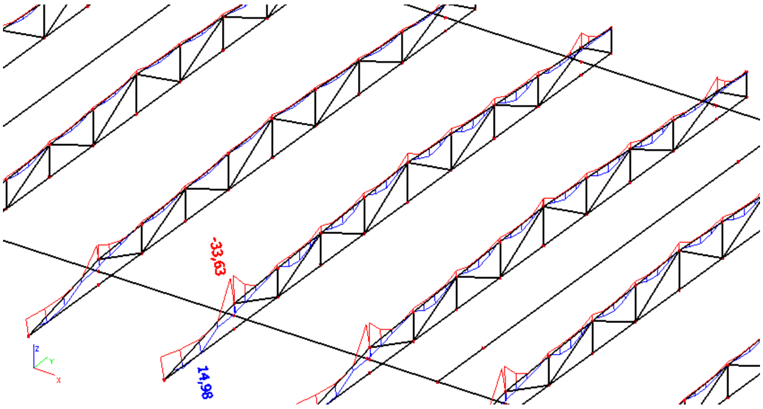
# 4. DIJAGRAMI REZNIH SILA I POMAKA

## 4.1. UVOD

Prikaz reznih sila rađen je tako da su prikazane anvelope dijegrama reznih sila za sve kombinacije opterećenja za pojedine nosive elemente (gornji pojas, donji pojas, ispuna, uzdužna greda, poprečna greda, stupovi i spreg)

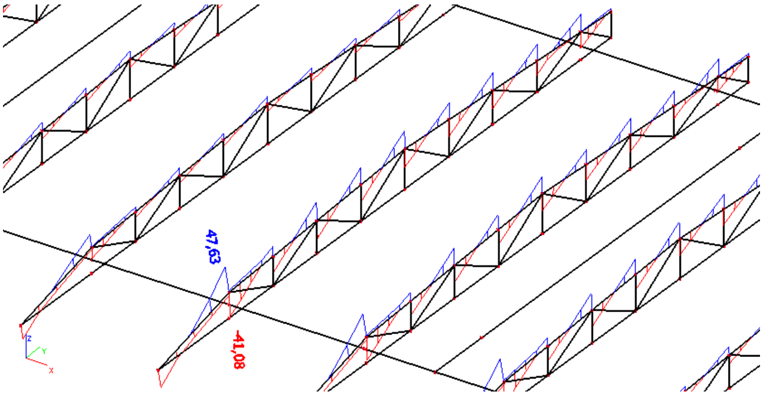
## 4.2. PRIKAZ REZNIH SILA GORNJEG POJASA REŠETKE

**My (kNm)**



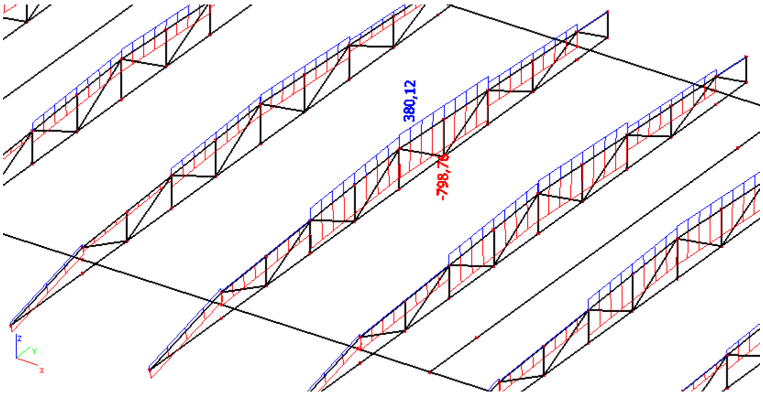

***Slika 4.1***: Proračunski moment savijanja gornjeg pojasa rešetke

**Vz (kN)**




***Slika 4.2***: Proračunska poprečna sila u gornjem pojasu rešetke

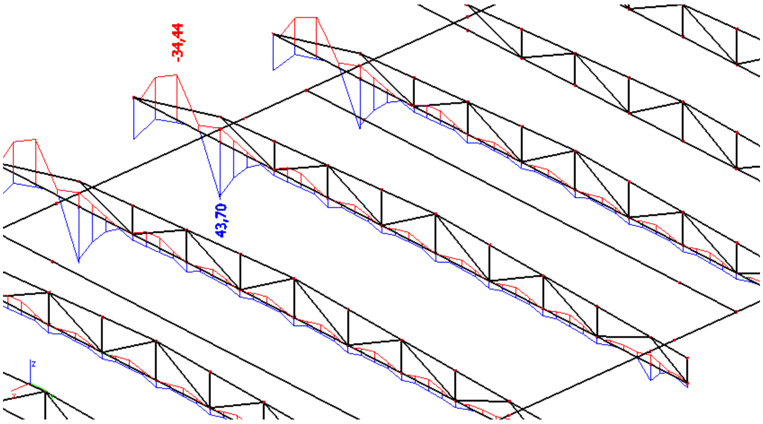
**N (kN)**




***Slika 4.3***: Proračunska uzdužna sila u gornjem pojaua rešetke

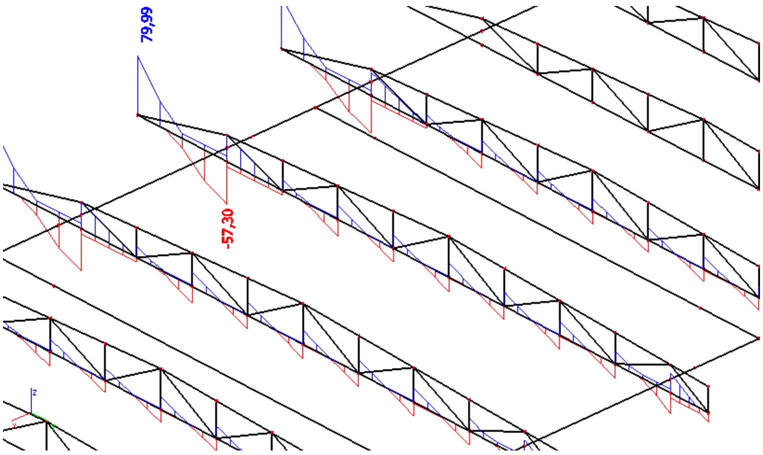
## 4.3. PRIKAZ REZNIH SILA DORNJEG POJASA REŠETKE

**My (kNm)**



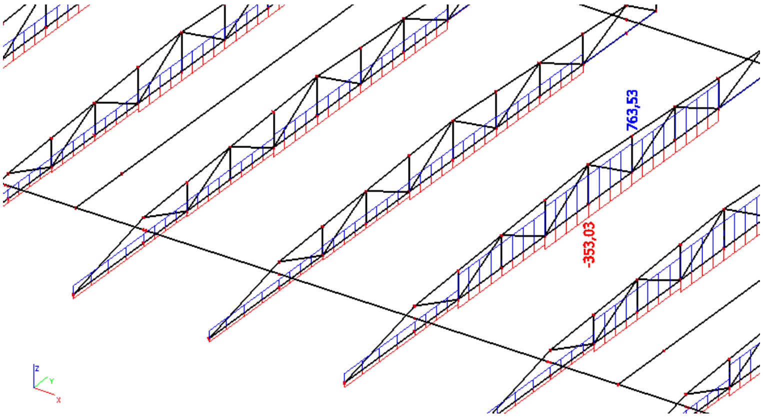

***Slika 4.4***: Proračunski moment savijanja donjeg pojasa rešetke

**Vz (kN)**




***Slika 4.5***: Proračunska poprečna sila u donjem pojasu rešetke

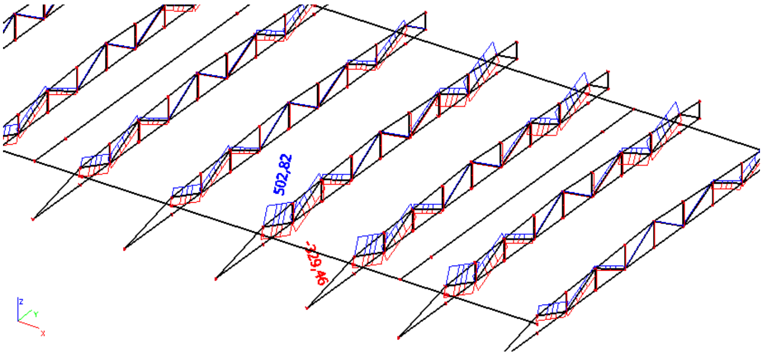
**N (kN)**




***Slika 4.6***: Proračunska uzdužna sila u donjem pojaua rešetke

## 4.4. PRIKAZ REZNIH SILA ISPUNE REŠETKE

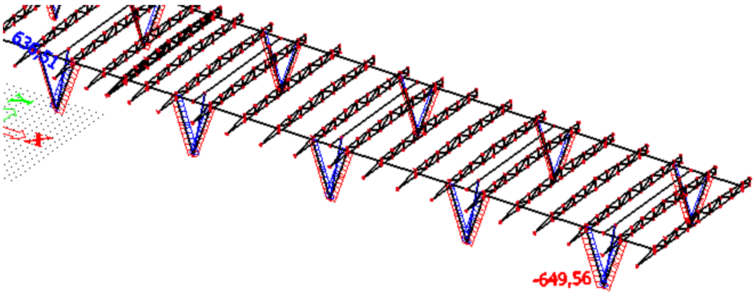
**N (kN)**




***Slika 4.7***: Proračunska uzdužna sila u ispuni rešetke

## 4.5. PRIKAZ REZNIH SILA STUPA

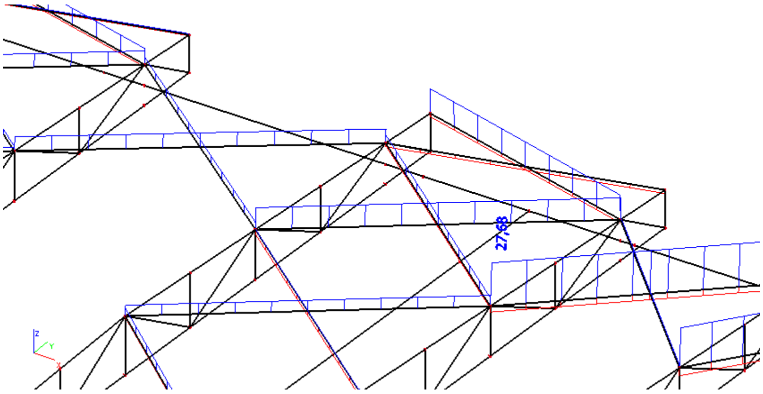
**N (kN)**




***Slika 4.8***: Proračunska uzdužna sila u stupovima

## 4.6. PRIKAZ REZNIH SILA SPREGA ZA STABILIZACIJU

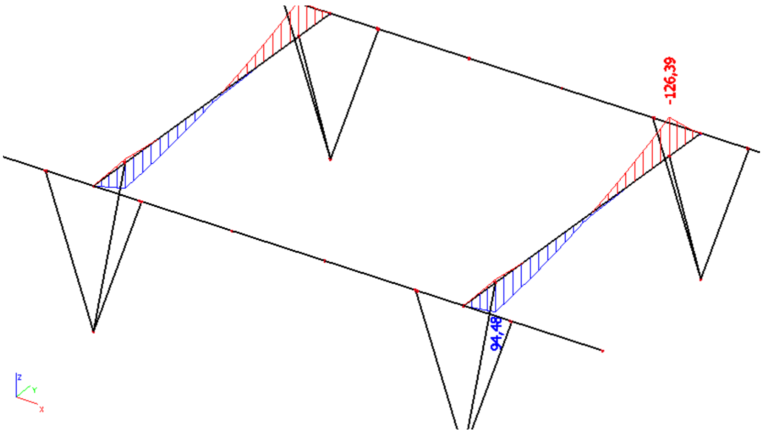
**N (kN)**




***Slika 4.9***: Proračunska uzdužna sila u spregovima

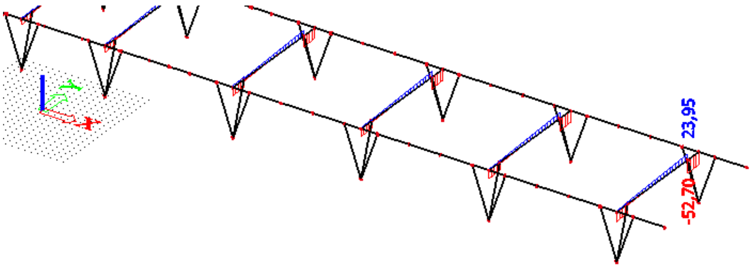
## 4.7. PRIKAZ REZNIH SILA POPREČNOG NOSAČA

**My (kNm)**



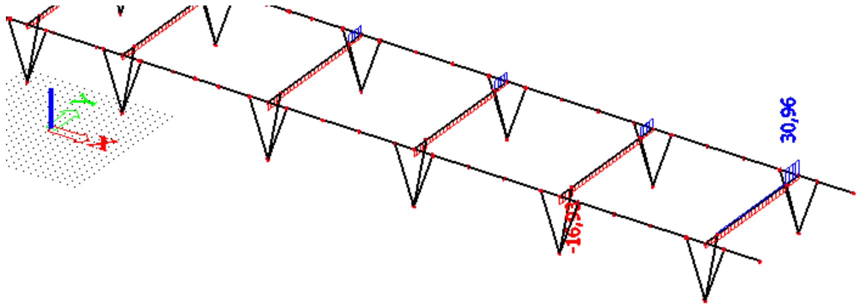

***Slika 4.10***: Proračunski moment savijanja poprečnog nosača

**Vz (kN)**




***Slika 4.11***: Proračunska poprečna sila poprečnog nosača

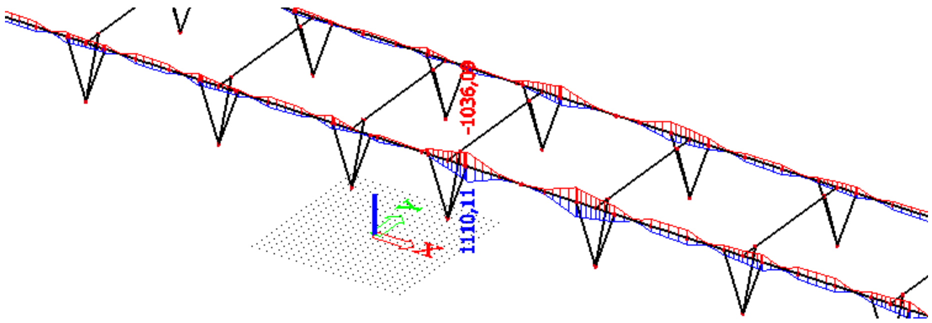
**N (kN)**




*Slika 4.12*: Proračunska uzdužna sila poprečnog nosača

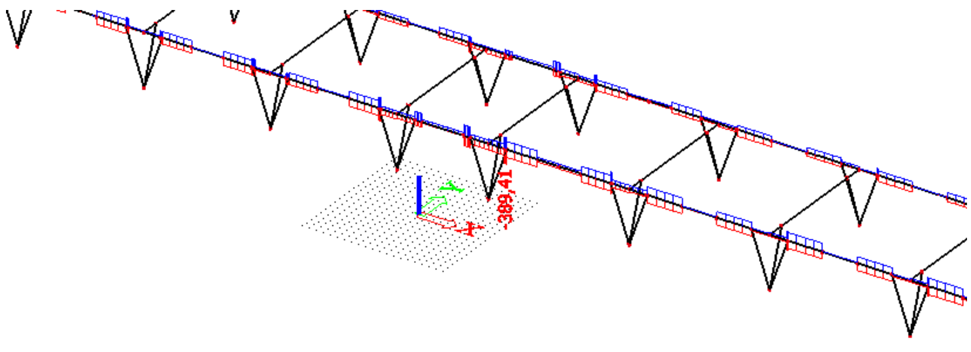
## 4.8. PRIKAZ REZNIH SILA UZDUŽNOG NOSAČA

**My (kNm)**



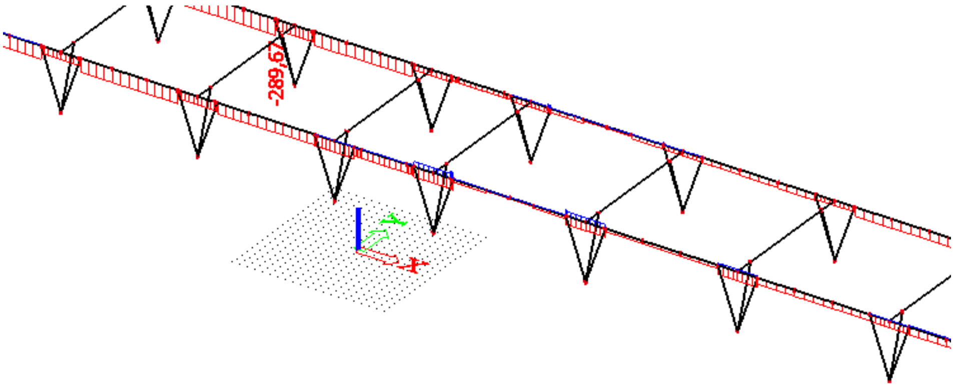

*Slika 4.13*: Proračunski moment savijanja uzdužnog nosača

**Vz (kN)**



*Slika 4.14*: Proračunska poprečna sila uzdužnog nosača

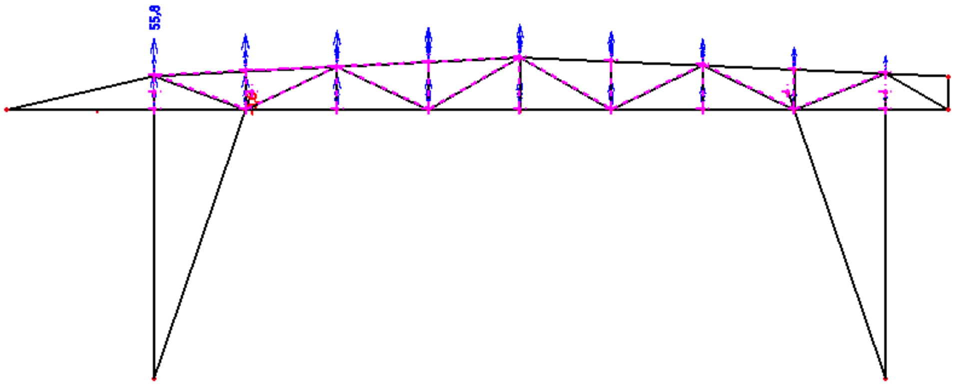
**N (kN)**




***Slika 4.15***: Proračunska uzdužna sila uzdužnog nosača

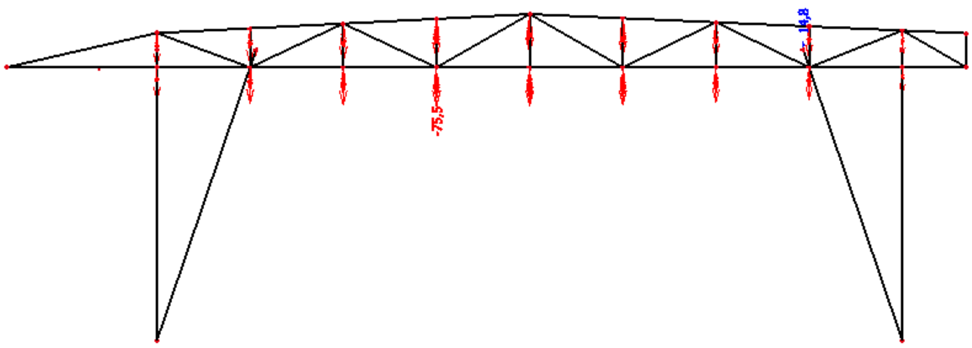
## 4.9. PRIKAZ MJERODAVNIH POMAKA ZA POJEDINI ELEMENT I NJIHOVA KONTROLA

Maksimalni pomak u prema gore rešetkastog poprečnog nosača




***Slika 4.16***: Anvelopa pomaka prema gore rešetkastog nosača

Maksimalni pomak prema dolje rešetkastog poprečnog nosača

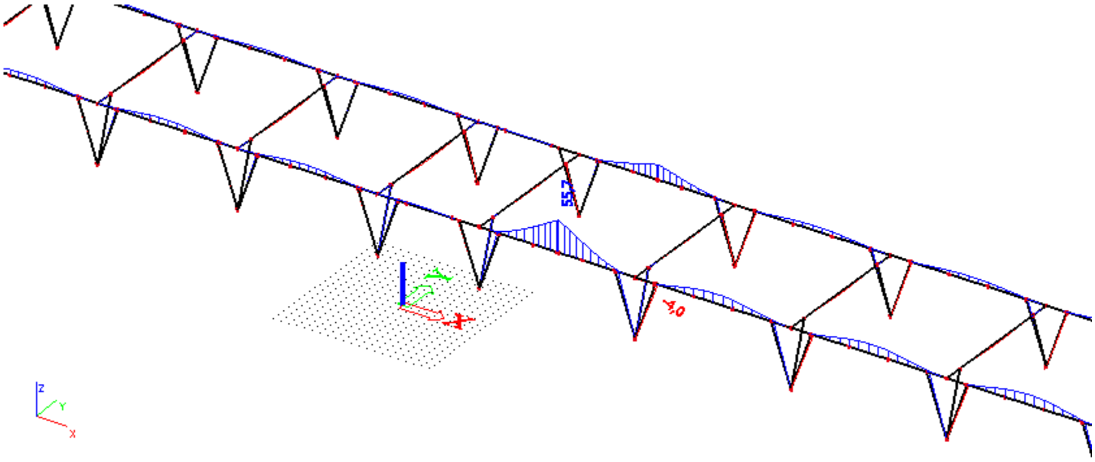



***Slika 4.17***: Anvelopa pomaka prema dolje rešetkastog nosača

Kontrola pomaka rešetkastog poprečnog nosača:

$u_{z,max}$ = 75,9 mm < l/200= 15200/200= 80 mm .... zadovoljava

Maksimalni pomak uzdužnog nosača



***Slika 4.18***: Anvelopa pomaka uzdužnog nosača

Kontrola pomaka uzdužnog nosača:

$u_{z,max}$ = 55,7 mm < l/250= 20000/200= 100 mm .... zadovoljava

# 5. PRORAČUN I DIMENZIONIRANJE KONSTRUKCIJE

## 5.1. PRORAČUNSKI MODEL

Proračun konstrukcije je rađen pomoću software-a *Scia Engineer 15* na temelju prostornog štapnog modela. Svaki element u modelu modeliran je kao jedan štap koji svojom krutošću i modulom elastičnosti materijala simulira svoje stvarne karakteristike presjeka.

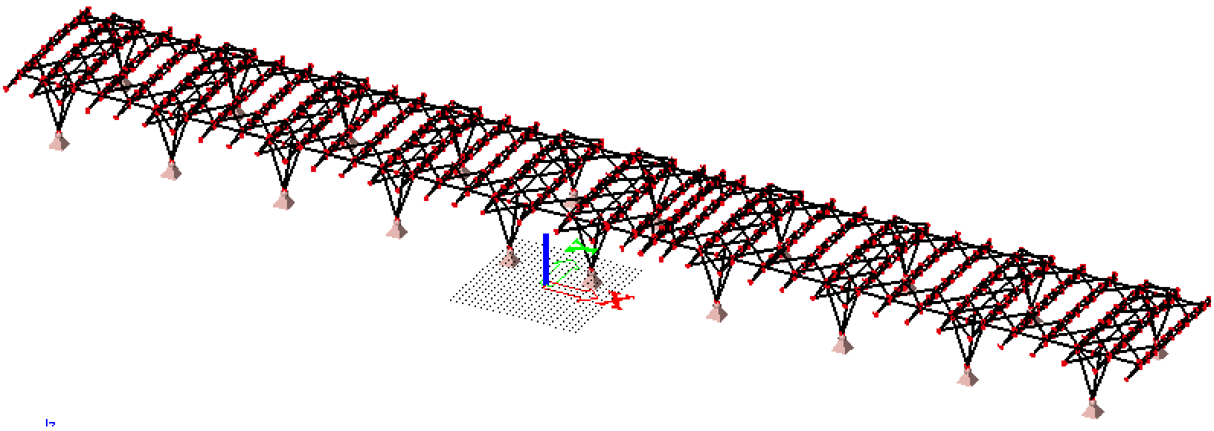
Za potrebe modela, kosi stupovi su uzeti kao elementi koji prenose samo uzdužnu sili, a kao ležajevi su im uzeti točkasti oslonci nepomični u sva tri ortogonalna smijera na donjoj strani i sglobni spoj sa uzdužnim, odnosno poprečim nosačem na gornjoj strani.

Na stupove se veže roštiljni sustav od dva paralelna udužna nosača koji su na mjestima stupova vezani poprečnim nosačem.

Roštiljni sustav greda čini oslonac poprečnim rešetkastim nosačima koji se oslanjaju na uzdužni nosač. Rešetkasti nosači su modelirani preko pojaseva i ispuna rešetke. Pojasevi su modelirani kao nosači koji nose i na savijanje i na uzdužnu silu, dok su ispune modelirane kao nosači koji nose samo na uzdužnu silu..

Poprečni rešetkasti nosači su na mjestu stupišta uhvaćeni, tj stabilizirani mekim zategama koje su prihvaćene za gornji pojas rešetke i koje su modelirane kao elementi koji nose samo na djelovanje vlačne sile.

Proračun je rađen linearno elastičnom analizom za sve konačne elemente konstrukcije.



***Slika 5.1***: Proračunski model konstrukcije

# 2. Dimenzioniranje gornjeg pojasa rešetke pozicije R1

Linear calculation, Extreme : Global
Selection : All
Combinations : GSN2
Cross-section : G_Pojas1 - CFRHS140X140X4

**EN 1993-1-1 Code Check**
National annex: Standard EN

| Member B408 | 11,261 m | CFRHS140X140X4 | S 235 | GSN2/1 | 0,61 - |
|---|---|---|---|---|---|

Note: EN 1993-1-3 article 1.1(3) specifies that this part does not apply to cold formed CHS and RHS sections.
The default EN 1993-1-1 code check is executed instead of the EN 1993-1-3 code check.

| Partial safety factors | |
|---|---|
| Gamma M0 for resistance of cross-sections | 1,00 |
| Gamma M1 for resistance to instability | 1,00 |
| Gamma M2 for resistance of net sections | 1,25 |

| Material | | |
|---|---|---|
| Yield strength fy | 235,0 | MPa |
| Ultimate strength fu | 360,0 | MPa |
| Fabrication | Cold formed | |

**...::SECTION CHECK::...**

**Classification for cross-section design**
According to EN 1993-1-1 article 5.5.2
**Classification of Internal Compression parts**
According to EN 1993-1-1 Table 5.2 Sheet 1

| | |
|---|---|
| Maximum width-to-thickness ratio | 32,00 |
| Class 1 Limit | 33,00 |
| Class 2 Limit | 38,00 |
| Class 3 Limit | 44,37 |

=> Section classified as Class 1 for cross-section design

**The critical check is on position 6.456 m**

| Internal forces | Calculated | Unit |
|---|---|---|
| N,Ed | -149,18 | kN |
| Vy,Ed | -3,90 | kN |
| Vz,Ed | 4,50 | kN |
| T,Ed | -0,29 | kNm |
| My,Ed | -1,20 | kNm |
| Mz,Ed | 5,92 | kNm |

**Compression check**
According to EN 1993-1-1 article 6.2.4 and formula (6.9)

| | | |
|---|---|---|
| A | 2,1350e-03 | $m^2$ |
| Nc,Rd | 501,73 | kN |
| Unity check | 0,30 | - |

**Bending moment check for My**
According to EN 1993-1-1 article 6.2.5 and formula (6.12),(6.13)

| | | |
|---|---|---|
| Wpl,y | 1,0815e-04 | $m^3$ |
| Mpl,y,Rd | 25,42 | kNm |
| Unity check | 0,05 | - |

**Bending moment check for Mz**
According to EN 1993-1-1 article 6.2.5 and formula (6.12),(6.13)

| | | |
|---|---|---|
| Wpl,z | 1,0815e-04 | $m^3$ |
| Mpl,z,Rd | 25,42 | kNm |
| Unity check | 0,23 | - |

**Shear check for Vy**
According to EN 1993-1-1 article 6.2.6 and formula (6.17)

| | | |
|---|---|---|
| Eta | 1,20 | |
| Av | 1,0675e-03 | $m^2$ |
| Vpl,y,Rd | 144,84 | kN |
| Unity check | 0,03 | - |

**Shear check for Vz**
According to EN 1993-1-1 article 6.2.6 and formula (6.17)

| | | |
|---|---|---|
| Eta | 1,20 | |
| Av | 1,0675e-03 | $m^2$ |
| Vpl,z,Rd | 144,84 | kN |
| Unity check | 0,03 | - |

**Torsion check**
According to EN 1993-1-1 article 6.2.7 and formula (6.23)

| | | |
|---|---|---|
| Tau,t,Ed | 2,0 | MPa |
| Tau,Rd | 135,7 | MPa |
| Unity check | 0,01 | - |

**Note:** The unity check for torsion is lower than the limit value of 0,05. Therefore torsion is considered as insignificant and is ignored in the combined checks.

**Combined bending, axial force and shear force check**
According to EN 1993-1-1 article 6.2.9.1 and formula (6.41)

| | | |
|---|---|---|
| MN,y,Rd | 23,43 | kNm |
| Alpha | 1,84 | |
| MN,z,Rd | 23,43 | kNm |
| Beta | 1,84 | |

Unity check (6.41) = 0,00 + 0,08 = 0,08 -

**Note:** Since the shear forces are less than half the plastic shear resistances their effect on the moment resistances is neglected.

The member satisfies the section check.

**...::STABILITY CHECK::...**
**Classification for member buckling design**
Decisive position for stability classification: 6,456 m
**Classification of Internal Compression parts**
According to EN 1993-1-1 Table 5.2 Sheet 1

| | |
|---|---|
| Maximum width-to-thickness ratio | 32,00 |
| Class 1 Limit | 33,00 |
| Class 2 Limit | 38,00 |
| Class 3 Limit | 44,37 |

=> Section classified as Class 1 for member buckling design

**Flexural Buckling check**
According to EN 1993-1-1 article 6.3.1.1 and formula (6.46)

| Buckling parameters | yy | zz | |
|---|---|---|---|
| Sway type | sway | non-sway | |
| System length L | 2,402 | 2,402 | m |
| Buckling factor k | 1,00 | 1,00 | |
| Buckling length Lcr | 2,402 | 2,402 | m |
| Critical Euler load Ncr | 2340,23 | 2340,23 | kN |
| Slenderness Lambda | 43,48 | 43,48 | |
| Relative slenderness Lambda,rel | 0,46 | 0,46 | |
| Limit slenderness Lambda,rel,0 | 0,20 | 0,20 | |
| Buckling curve | c | c | |
| Imperfection Alpha | 0,49 | 0,49 | |
| Reduction factor Chi | 0,86 | 0,86 | |
| Buckling resistance Nb,Rd | 433,21 | 433,21 | kN |

| Flexural Buckling verification | | |
|---|---|---|
| Cross-section area A | 2,1350e-03 | $m^2$ |
| Buckling resistance Nb,Rd | 433,21 | kN |
| Unity check | 0,34 | - |

**Torsional(-Flexural) Buckling check**
According to EN 1993-1-1 article 6.3.1.1 and formula (6.46)
**Note:** The cross-section concerns a RHS section which is not susceptible to Torsional(-Flexural) Buckling.

**Lateral Torsional Buckling check**
According to EN 1993-1-1 article 6.3.2.1
**Note:** The cross-section concerns an RHS section with 'h / b < 10 / Lambda,rel,z'.
This section is thus not susceptible to Lateral Torsional Buckling.

**Bending and axial compression check**
According to EN 1993-1-1 article 6.3.3 and formula (6.61),(6.62)

| Bending and axial compression check parameters | | |
|---|---|---|
| Interaction method | alternative method 1 | |
| Cross-section area A | 2,1350e-03 | $m^2$ |
| Cross-section plastic modulus Wpl,y | 1,0815e-04 | $m^3$ |
| Cross-section plastic modulus Wpl,z | 1,0815e-04 | $m^3$ |
| Design compression force N,Ed | 149,18 | kN |
| Design bending moment (maximum) My,Ed | 1,65 | kNm |
| Design bending moment (maximum) Mz,Ed | 5,92 | kNm |
| Characteristic compression resistance N,Rk | 501,73 | kN |
| Characteristic moment resistance My,Rk | 25,42 | kNm |
| Characteristic moment resistance Mz,Rk | 25,42 | kNm |
| Reduction factor Chi,y | 0,86 | |
| Reduction factor Chi,z | 0,86 | |
| Reduction factor Chi,LT | 1,00 | |
| Interaction factor k,yy | 1,00 | |
| Interaction factor k,yz | 0,59 | |

| Bending and axial compression check parameters | | |
| --- | --- | --- |
| Interaction factor k,zy | 0,62 | |
| Interaction factor k,zz | 0,96 | |

Maximum moment My,Ed is derived from beam B408 position 7,657 m.
Maximum moment Mz,Ed is derived from beam B408 position 0,000 m.

| Interaction method 1 parameters | | |
| --- | --- | --- |
| Critical Euler load N,cr,y | 2340,23 | kN |
| Critical Euler load N,cr,z | 2340,23 | kN |
| Elastic critical load N,cr,T | 136458,58 | kN |
| Cross-section plastic modulus Wpl,y | 1,0815e-04 | $m^3$ |
| Cross-section elastic modulus Wel,y | 9,3090e-05 | $m^3$ |
| Cross-section plastic modulus Wpl,z | 1,0815e-04 | $m^3$ |
| Cross-section elastic modulus Wel,z | 9,3090e-05 | $m^3$ |
| Second moment of area Iy | 6,5162e-06 | $m^4$ |
| Second moment of area Iz | 6,5162e-06 | $m^4$ |
| Torsional constant It | 1,0233e-05 | $m^4$ |
| Method for equivalent moment factor C,my,0 | Table A.2 Line 2 (General) | |
| Design bending moment (maximum) My,Ed | 1,65 | kNm |
| Maximum relative deflection delta,z | -0,7 | mm |
| Equivalent moment factor C,my,0 | 1,00 | |
| Method for equivalent moment factor C,mz,0 | Table A.2 Line 2 (General) | |
| Design bending moment (maximum) Mz,Ed | 5,92 | kNm |
| Maximum relative deflection delta,y | -0,8 | mm |
| Equivalent moment factor C,mz,0 | 0,96 | |
| Factor mu,y | 0,99 | |
| Factor mu,z | 0,99 | |
| Factor epsilon,y | 0,25 | |
| Factor a,LT | 0,00 | |
| Critical moment for uniform bending Mcr,0 | 1396,18 | kNm |
| Relative slenderness Lambda,rel,0 | 0,13 | |
| Limit relative slenderness Lambda,rel,0,lim | 0,21 | |
| Equivalent moment factor C,my | 1,00 | |
| Equivalent moment factor C,mz | 0,96 | |
| Equivalent moment factor C,mLT | 1,00 | |
| Factor b,LT | 0,00 | |
| Factor c,LT | 0,00 | |
| Factor d,LT | 0,00 | |
| Factor e,LT | 0,00 | |
| Factor w,y | 1,16 | |
| Factor w,z | 1,16 | |
| Factor n,pl | 0,30 | |
| Maximum relative slenderness Lambda,rel,max | 0,46 | |
| Factor C,yy | 1,05 | |
| Factor C,yz | 1,03 | |
| Factor C,zy | 1,03 | |
| Factor C,zz | 1,06 | |

Unity check (6.61) = 0,34 + 0,07 + 0,14 = 0,55 -
Unity check (6.62) = 0,34 + 0,04 + 0,22 = 0,61 -

The member satisfies the stability check.

## 3. Dimenzioniranje gornjeg pojasa rešetke pozicije R2

Linear calculation, Extreme : Global
Selection : All
Combinations : GSN2
Cross-section : G_Pojas2 - CFRHS140X140X5

**EN 1993-1-1 Code Check**
National annex: Standard EN

| | | | | | |
| --- | --- | --- | --- | --- | --- |
| **Member B358** | **11,261 m** | **CFRHS140X140X5** | **S 235** | **GSN2/1** | **0,82 -** |

Note: EN 1993-1-3 article 1.1(3) specifies that this part does not apply to cold formed CHS and RHS sections.
The default EN 1993-1-1 code check is executed instead of the EN 1993-1-3 code check.

| Partial safety factors | |
| --- | --- |
| Gamma M0 for resistance of cross-sections | 1,00 |
| Gamma M1 for resistance to instability | 1,00 |
| Gamma M2 for resistance of net sections | 1,25 |

| Material | | |
| --- | --- | --- |
| Yield strength fy | 235,0 | MPa |
| Ultimate strength fu | 360,0 | MPa |
| Fabrication | Cold formed | |

**...::SECTION CHECK::...**

**Classification for cross-section design**
According to EN 1993-1-1 article 5.5.2

**Classification of Internal Compression parts**
According to EN 1993-1-1 Table 5.2 Sheet 1

| | |
|---|---|
| Maximum width-to-thickness ratio | 25,00 |
| Class 1 Limit | 33,00 |
| Class 2 Limit | 38,00 |
| Class 3 Limit | 46,74 |

=> Section classified as Class 1 for cross-section design

**The critical check is on position 6.456 m**

| Internal forces | Calculated | Unit |
|---|---|---|
| N,Ed | -309,84 | kN |
| Vy,Ed | -4,45 | kN |
| Vz,Ed | 12,22 | kN |
| T,Ed | -0,44 | kNm |
| My,Ed | -3,81 | kNm |
| Mz,Ed | 5,42 | kNm |

**Compression check**
According to EN 1993-1-1 article 6.2.4 and formula (6.9)

| | | |
|---|---|---|
| A | 2,6360e-03 | $m^2$ |
| Nc,Rd | 619,46 | kN |
| Unity check | 0,50 | - |

**Bending moment check for My**
According to EN 1993-1-1 article 6.2.5 and formula (6.12),(6.13)

| | | |
|---|---|---|
| Wpl,y | 1,3230e-04 | $m^3$ |
| Mpl,y,Rd | 31,09 | kNm |
| Unity check | 0,12 | - |

**Bending moment check for Mz**
According to EN 1993-1-1 article 6.2.5 and formula (6.12),(6.13)

| | | |
|---|---|---|
| Wpl,z | 1,3230e-04 | $m^3$ |
| Mpl,z,Rd | 31,09 | kNm |
| Unity check | 0,17 | - |

**Shear check for Vy**
According to EN 1993-1-1 article 6.2.6 and formula (6.17)

| | | |
|---|---|---|
| Eta | 1,20 | |
| Av | 1,3180e-03 | $m^2$ |
| Vpl,y,Rd | 178,82 | kN |
| Unity check | 0,02 | - |

**Shear check for Vz**
According to EN 1993-1-1 article 6.2.6 and formula (6.17)

| | | |
|---|---|---|
| Eta | 1,20 | |
| Av | 1,3180e-03 | $m^2$ |
| Vpl,z,Rd | 178,82 | kN |
| Unity check | 0,07 | - |

**Torsion check**
According to EN 1993-1-1 article 6.2.7 and formula (6.23)

| | | |
|---|---|---|
| Tau,t,Ed | 2,4 | MPa |
| Tau,Rd | 135,7 | MPa |
| Unity check | 0,02 | - |

**Note:** The unity check for torsion is lower than the limit value of 0,05. Therefore torsion is considered as insignificant and is ignored in the combined checks.

**Combined bending, axial force and shear force check**
According to EN 1993-1-1 article 6.2.9.1 and formula (6.41)

| | | |
|---|---|---|
| MN,y,Rd | 20,30 | kNm |
| Alpha | 2,31 | |
| MN,z,Rd | 20,30 | kNm |
| Beta | 2,31 | |

Unity check (6.41) = 0,02 + 0,05 = 0,07 -

**Note:** Since the shear forces are less than half the plastic shear resistances their effect on the moment resistances is neglected.

The member satisfies the section check.

**....::STABILITY CHECK::...**
**Classification for member buckling design**
Decisive position for stability classification: 6,456 m
**Classification of Internal Compression parts**
According to EN 1993-1-1 Table 5.2 Sheet 1

| | |
|---|---|
| Maximum width-to-thickness ratio | 25,00 |
| Class 1 Limit | 33,00 |
| Class 2 Limit | 38,00 |
| Class 3 Limit | 46,74 |

=> Section classified as Class 1 for member buckling design

**Flexural Buckling check**
According to EN 1993-1-1 article 6.3.1.1 and formula (6.46)

| Buckling parameters | yy | zz | |
|---|---|---|---|
| Sway type | sway | non-sway | |
| System length L | 2,402 | 2,402 | m |
| Buckling factor k | 1,00 | 1,00 | |
| Buckling length Lcr | 2,402 | 2,402 | m |
| Critical Euler load Ncr | 2839,24 | 2839,24 | kN |
| Slenderness Lambda | 43,87 | 43,87 | |
| Relative slenderness Lambda,rel | 0,47 | 0,47 | |
| Limit slenderness Lambda,rel,0 | 0,20 | 0,20 | |
| Buckling curve | c | c | |
| Imperfection Alpha | 0,49 | 0,49 | |
| Reduction factor Chi | 0,86 | 0,86 | |
| Buckling resistance Nb,Rd | 533,48 | 533,48 | kN |

| Flexural Buckling verification | | |
|---|---|---|
| Cross-section area A | 2,6360e-03 | $m^2$ |
| Buckling resistance Nb,Rd | 533,48 | kN |
| Unity check | 0,58 | - |

**Torsional(-Flexural) Buckling check**
According to EN 1993-1-1 article 6.3.1.1 and formula (6.46)
**Note:** The cross-section concerns a RHS section which is not susceptible to Torsional(-Flexural) Buckling.

**Lateral Torsional Buckling check**
According to EN 1993-1-1 article 6.3.2.1
**Note:** The cross-section concerns an RHS section with 'h / b < 10 / Lambda,rel,z'.
This section is thus not susceptible to Lateral Torsional Buckling.

**Bending and axial compression check**
According to EN 1993-1-1 article 6.3.3 and formula (6.61),(6.62)

| Bending and axial compression check parameters | | |
|---|---|---|
| Interaction method | alternative method 1 | |
| Cross-section area A | 2,6360e-03 | $m^2$ |
| Cross-section plastic modulus Wpl,y | 1,3230e-04 | $m^3$ |
| Cross-section plastic modulus Wpl,z | 1,3230e-04 | $m^3$ |
| Design compression force N,Ed | 309,84 | kN |
| Design bending moment (maximum) My,Ed | 3,92 | kNm |
| Design bending moment (maximum) Mz,Ed | 5,42 | kNm |
| Characteristic compression resistance N,Rk | 619,46 | kN |
| Characteristic moment resistance My,Rk | 31,09 | kNm |
| Characteristic moment resistance Mz,Rk | 31,09 | kNm |
| Reduction factor Chi,y | 0,86 | |
| Reduction factor Chi,z | 0,86 | |
| Reduction factor Chi,LT | 1,00 | |
| Interaction factor k,yy | 1,00 | |
| Interaction factor k,yz | 0,56 | |
| Interaction factor k,zy | 0,62 | |
| Interaction factor k,zz | 0,90 | |

Maximum moment My,Ed is derived from beam B358 position 7,657 m.
Maximum moment Mz,Ed is derived from beam B358 position 0,000 m.

| Interaction method 1 parameters | | |
|---|---|---|
| Critical Euler load N,cr,y | 2839,24 | kN |
| Critical Euler load N,cr,z | 2839,24 | kN |
| Elastic critical load N,cr,T | 170437,70 | kN |
| Cross-section plastic modulus Wpl,y | 1,3230e-04 | $m^3$ |
| Cross-section elastic modulus Wel,y | 1,1294e-04 | $m^3$ |
| Cross-section plastic modulus Wpl,z | 1,3230e-04 | $m^3$ |
| Cross-section elastic modulus Wel,z | 1,1294e-04 | $m^3$ |
| Second moment of area Iy | 7,9056e-06 | $m^4$ |
| Second moment of area Iz | 7,9056e-06 | $m^4$ |
| Torsional constant It | 1,2558e-05 | $m^4$ |
| Method for equivalent moment factor C,my,0 | Table A.2 Line 2 (General) | |
| Design bending moment (maximum) My,Ed | 3,92 | kNm |
| Maximum relative deflection delta,z | -1,3 | mm |
| Equivalent moment factor C,my,0 | 0,99 | |
| Method for equivalent moment factor C,mz,0 | Table A.2 Line 2 (General) | |
| Design bending moment (maximum) Mz,Ed | 5,42 | kNm |
| Maximum relative deflection delta,y | -0,3 | mm |
| Equivalent moment factor C,mz,0 | 0,91 | |
| Factor mu,y | 0,98 | |

| Interaction method 1 parameters | | |
|---|---|---|
| Factor mu,z | 0,98 | |
| Factor epsilon,y | 0,29 | |
| Factor a,LT | 0,00 | |
| Critical moment for uniform bending Mcr,0 | 1703,70 | kNm |
| Relative slenderness Lambda,rel,0 | 0,14 | |
| Limit relative slenderness Lambda,rel,0,lim | 0,21 | |
| Equivalent moment factor C,my | 0,99 | |
| Equivalent moment factor C,mz | 0,91 | |
| Equivalent moment factor C,mLT | 1,00 | |
| Factor b,LT | 0,00 | |
| Factor c,LT | 0,00 | |
| Factor d,LT | 0,00 | |
| Factor e,LT | 0,00 | |
| Factor w,y | 1,17 | |
| Factor w,z | 1,17 | |
| Factor n,pl | 0,50 | |
| Maximum relative slenderness Lambda,rel,max | 0,47 | |
| Factor C,yy | 1,09 | |
| Factor C,yz | 1,07 | |
| Factor C,zy | 1,05 | |
| Factor C,zz | 1,11 | |

Unity check (6.61) = 0,58 + 0,13 + 0,10 = 0,80 -
Unity check (6.62) = 0,58 + 0,08 + 0,16 = 0,82 -

The member satisfies the stability check.

# 4. Dimenzioniranje gornjeg pojasa rešetke pozicije R3

Linear calculation, Extreme : Global
Selection : All
Combinations : GSN2
Cross-section : G_Pojas3 - CFRHS140X140X10

**EN 1993-1-1 Code Check**
National annex: Standard EN

| | | | | | |
|---|---|---|---|---|---|
| **Member B508** | **11,261 m** | **CFRHS140X140X10** | **S 235** | **GSN2/1** | **0,80 -** |

Note: EN 1993-1-3 article 1.1(3) specifies that this part does not apply to cold formed CHS and RHS sections.
The default EN 1993-1-1 code check is executed instead of the EN 1993-1-3 code check.

| Partial safety factors | |
|---|---|
| Gamma M0 for resistance of cross-sections | 1,00 |
| Gamma M1 for resistance to instability | 1,00 |
| Gamma M2 for resistance of net sections | 1,25 |

| Material | | |
|---|---|---|
| Yield strength fy | 235,0 | MPa |
| Ultimate strength fu | 360,0 | MPa |
| Fabrication | Cold formed | |

**...::SECTION CHECK::...**

**Classification for cross-section design**
According to EN 1993-1-1 article 5.5.2
**Classification of Internal Compression parts**
According to EN 1993-1-1 Table 5.2 Sheet 1

| | |
|---|---|
| Maximum width-to-thickness ratio | 11,00 |
| Class 1 Limit | 33,00 |
| Class 2 Limit | 38,00 |
| Class 3 Limit | 48,03 |

=> Section classified as Class 1 for cross-section design

**The critical check is on position 6.456 m**

| Internal forces | Calculated | Unit |
|---|---|---|
| N,Ed | -410,23 | kN |
| Vy,Ed | 2,86 | kN |
| Vz,Ed | 15,13 | kN |
| T,Ed | -0,08 | kNm |
| My,Ed | -4,04 | kNm |
| Mz,Ed | -2,31 | kNm |

**Compression check**
According to EN 1993-1-1 article 6.2.4 and formula (6.9)

| | | |
|---|---|---|
| A | 4,8570e-03 | $m^2$ |
| Nc,Rd | 1141,40 | kN |
| Unity check | 0,36 | - |

**Bending moment check for My**
According to EN 1993-1-1 article 6.2.5 and formula (6.12),(6.13)

| | | |
|---|---|---|
| Wpl,y | 2,3038e-04 | $m^3$ |
| Mpl,y,Rd | 54,14 | kNm |
| Unity check | 0,07 | - |

**Bending moment check for Mz**
According to EN 1993-1-1 article 6.2.5 and formula (6.12),(6.13)

| | | |
|---|---|---|
| Wpl,z | 2,3038e-04 | $m^3$ |
| Mpl,z,Rd | 54,14 | kNm |
| Unity check | 0,04 | - |

**Shear check for Vy**
According to EN 1993-1-1 article 6.2.6 and formula (6.17)

| | | |
|---|---|---|
| Eta | 1,20 | |
| Av | 2,4285e-03 | $m^2$ |
| Vpl,y,Rd | 329,49 | kN |
| Unity check | 0,01 | - |

**Shear check for Vz**
According to EN 1993-1-1 article 6.2.6 and formula (6.17)

| | | |
|---|---|---|
| Eta | 1,20 | |
| Av | 2,4285e-03 | $m^2$ |
| Vpl,z,Rd | 329,49 | kN |
| Unity check | 0,05 | - |

**Torsion check**
According to EN 1993-1-1 article 6.2.7 and formula (6.23)

| | | |
|---|---|---|
| Tau,t,Ed | 0,2 | MPa |
| Tau,Rd | 135,7 | MPa |
| Unity check | 0,00 | - |

**Note:** The unity check for torsion is lower than the limit value of 0,05. Therefore torsion is considered as insignificant and is ignored in the combined checks.

**Combined bending, axial force and shear force check**
According to EN 1993-1-1 article 6.2.9.1 and formula (6.41)

| | | |
|---|---|---|
| MN,y,Rd | 44,00 | kNm |
| Alpha | 1,94 | |
| MN,z,Rd | 44,00 | kNm |
| Beta | 1,94 | |

Unity check (6.41) = 0,01 + 0,00 = 0,01 -

**Note:** Since the shear forces are less than half the plastic shear resistances their effect on the moment resistances is neglected.

The member satisfies the section check.

**...::STABILITY CHECK::...**
**Classification for member buckling design**
Decisive position for stability classification: 4,054 m
**Classification of Internal Compression parts**
According to EN 1993-1-1 Table 5.2 Sheet 1

| | |
|---|---|
| Maximum width-to-thickness ratio | 11,00 |
| Class 1 Limit | 33,00 |
| Class 2 Limit | 38,00 |
| Class 3 Limit | 46,52 |

=> Section classified as Class 1 for member buckling design

**Flexural Buckling check**
According to EN 1993-1-1 article 6.3.1.1 and formula (6.46)

| Buckling parameters | yy | zz | |
|---|---|---|---|
| Sway type | sway | non-sway | |
| System length L | 4,805 | 4,805 | m |
| Buckling factor k | 1,00 | 1,00 | |
| Buckling length Lcr | 4,805 | 4,805 | m |
| Critical Euler load Ncr | 1177,68 | 1177,68 | kN |
| Slenderness Lambda | 92,45 | 92,45 | |
| Relative slenderness Lambda,rel | 0,98 | 0,98 | |
| Limit slenderness Lambda,rel,0 | 0,20 | 0,20 | |
| Buckling curve | c | c | |
| Imperfection Alpha | 0,49 | 0,49 | |
| Reduction factor Chi | 0,55 | 0,55 | |
| Buckling resistance Nb,Rd | 626,63 | 626,63 | kN |

| Flexural Buckling verification | | |
|---|---|---|
| Cross-section area A | 4,8570e-03 | $m^2$ |
| Buckling resistance Nb,Rd | 626,63 | kN |
| Unity check | 0,65 | - |

**Torsional(-Flexural) Buckling check**
According to EN 1993-1-1 article 6.3.1.1 and formula (6.46)
**Note:** The cross-section concerns a RHS section which is not susceptible to Torsional(-Flexural) Buckling.

**Lateral Torsional Buckling check**
According to EN 1993-1-1 article 6.3.2.1
**Note:** The cross-section concerns an RHS section with 'h / b < 10 / Lambda,rel,z'.
This section is thus not susceptible to Lateral Torsional Buckling.

**Bending and axial compression check**
According to EN 1993-1-1 article 6.3.3 and formula (6.61),(6.62)

| Bending and axial compression check parameters | | |
|---|---|---|
| Interaction method | alternative method 1 | |
| Cross-section area A | 4,8570e-03 | $m^2$ |
| Cross-section plastic modulus Wpl,y | 2,3038e-04 | $m^3$ |
| Cross-section plastic modulus Wpl,z | 2,3038e-04 | $m^3$ |
| Design compression force N,Ed | 410,23 | kN |
| Design bending moment (maximum) My,Ed | 5,56 | kNm |
| Design bending moment (maximum) Mz,Ed | 4,56 | kNm |
| Characteristic compression resistance N,Rk | 1141,40 | kN |
| Characteristic moment resistance My,Rk | 54,14 | kNm |
| Characteristic moment resistance Mz,Rk | 54,14 | kNm |
| Reduction factor Chi,y | 0,55 | |
| Reduction factor Chi,z | 0,55 | |
| Reduction factor Chi,LT | 1,00 | |
| Interaction factor k,yy | 1,00 | |
| Interaction factor k,yz | 0,53 | |
| Interaction factor k,zy | 0,69 | |
| Interaction factor k,zz | 0,81 | |

Maximum moment My,Ed is derived from beam B508 position 5,255 m.
Maximum moment Mz,Ed is derived from beam B508 position 8,858 m.

| Interaction method 1 parameters | | |
|---|---|---|
| Critical Euler load N,cr,y | 1177,68 | kN |
| Critical Euler load N,cr,z | 1177,68 | kN |
| Elastic critical load N,cr,T | 340785,68 | kN |
| Cross-section plastic modulus Wpl,y | 2,3038e-04 | $m^3$ |
| Cross-section elastic modulus Wel,y | 1,8738e-04 | $m^3$ |
| Cross-section plastic modulus Wpl,z | 2,3038e-04 | $m^3$ |
| Cross-section elastic modulus Wel,z | 1,8738e-04 | $m^3$ |
| Second moment of area Iy | 1,3117e-05 | $m^4$ |
| Second moment of area Iz | 1,3117e-05 | $m^4$ |
| Torsional constant It | 2,2739e-05 | $m^4$ |
| Method for equivalent moment factor C,my,0 | Table A.2 Line 2 (General) | |
| Design bending moment (maximum) My,Ed | 5,56 | kNm |
| Maximum relative deflection delta,z | -2,4 | mm |
| Equivalent moment factor C,my,0 | 0,83 | |
| Method for equivalent moment factor C,mz,0 | Table A.2 Line 2 (General) | |
| Design bending moment (maximum) Mz,Ed | 4,56 | kNm |
| Maximum relative deflection delta,y | 0,5 | mm |
| Equivalent moment factor C,mz,0 | 0,69 | |
| Factor mu,y | 0,81 | |
| Factor mu,z | 0,81 | |
| Factor epsilon,y | 0,35 | |
| Factor a,LT | 0,00 | |
| Critical moment for uniform bending Mcr,0 | 1472,31 | kNm |
| Relative slenderness Lambda,rel,0 | 0,19 | |
| Limit relative slenderness Lambda,rel,0,lim | 0,20 | |
| Equivalent moment factor C,my | 0,83 | |
| Equivalent moment factor C,mz | 0,69 | |
| Equivalent moment factor C,mLT | 1,00 | |
| Factor b,LT | 0,00 | |
| Factor c,LT | 0,00 | |
| Factor d,LT | 0,00 | |
| Factor e,LT | 0,00 | |
| Factor w,y | 1,23 | |
| Factor w,z | 1,23 | |
| Factor n,pl | 0,36 | |
| Maximum relative slenderness Lambda,rel,max | 0,98 | |
| Factor C,yy | 1,02 | |
| Factor C,yz | 0,97 | |
| Factor C,zy | 0,89 | |
| Factor C,zz | 1,06 | |

Unity check (6.61) = 0,65 + 0,10 + 0,04 = 0,80 -
Unity check (6.62) = 0,65 + 0,07 + 0,07 = 0,79 -

The member satisfies the stability check.

# 5. Dimenzioniranje gornjeg pojasa rešetke pozicije R4

Linear calculation, Extreme : Global
Selection : All
Combinations : GSN2
Cross-section : G_Pojas4 - CFRHS140X140X6

**EN 1993-1-1 Code Check**
National annex: Standard EN

| | | | | | |
|---|---|---|---|---|---|
| **Member B334** | **9,612 m** | **CFRHS140X140X6** | **S 235** | **GSN2/1** | **0,93 -** |

Note: EN 1993-1-3 article 1.1(3) specifies that this part does not apply to cold formed CHS and RHS sections.
The default EN 1993-1-1 code check is executed instead of the EN 1993-1-3 code check.

| Partial safety factors | |
|---|---|
| Gamma M0 for resistance of cross-sections | 1,00 |
| Gamma M1 for resistance to instability | 1,00 |
| Gamma M2 for resistance of net sections | 1,25 |

| Material | | |
|---|---|---|
| Yield strength fy | 235,0 | MPa |
| Ultimate strength fu | 360,0 | MPa |
| Fabrication | Cold formed | |

**...::SECTION CHECK::...**

**Classification for cross-section design**
According to EN 1993-1-1 article 5.5.2
**Classification of Internal Compression parts**
According to EN 1993-1-1 Table 5.2 Sheet 1

| | |
|---|---|
| Maximum width-to-thickness ratio | 20,33 |
| Class 1 Limit | 33,00 |
| Class 2 Limit | 38,00 |
| Class 3 Limit | 47,76 |

=> Section classified as Class 1 for cross-section design

**The critical check is on position 4.806 m**

| Internal forces | Calculated | Unit |
|---|---|---|
| N,Ed | -333,80 | kN |
| Vy,Ed | 3,09 | kN |
| Vz,Ed | -13,36 | kN |
| T,Ed | 0,15 | kNm |
| My,Ed | -4,38 | kNm |
| Mz,Ed | 3,02 | kNm |

**Compression check**
According to EN 1993-1-1 article 6.2.4 and formula (6.9)

| | | |
|---|---|---|
| A | 3,1230e-03 | $m^2$ |
| Nc,Rd | 733,90 | kN |
| Unity check | 0,45 | - |

**Bending moment check for My**
According to EN 1993-1-1 article 6.2.5 and formula (6.12),(6.13)

| | | |
|---|---|---|
| Wpl,y | 1,5533e-04 | $m^3$ |
| Mpl,y,Rd | 36,50 | kNm |
| Unity check | 0,12 | - |

**Bending moment check for Mz**
According to EN 1993-1-1 article 6.2.5 and formula (6.12),(6.13)

| | | |
|---|---|---|
| Wpl,z | 1,5533e-04 | $m^3$ |
| Mpl,z,Rd | 36,50 | kNm |
| Unity check | 0,08 | - |

**Shear check for Vy**
According to EN 1993-1-1 article 6.2.6 and formula (6.17)

| | | |
|---|---|---|
| Eta | 1,20 | |
| Av | 1,5615e-03 | $m^2$ |
| Vpl,y,Rd | 211,86 | kN |
| Unity check | 0,01 | - |

**Shear check for Vz**
According to EN 1993-1-1 article 6.2.6 and formula (6.17)

| | | |
|---|---|---|
| Eta | 1,20 | |
| Av | 1,5615e-03 | $m^2$ |

| | | |
|---|---|---|
| Vpl,z,Rd | 211,86 | kN |
| Unity check | 0,06 | - |

**Torsion check**
According to EN 1993-1-1 article 6.2.7 and formula (6.23)

| | | |
|---|---|---|
| Tau,t,Ed | 0,7 | MPa |
| Tau,Rd | 135,7 | MPa |
| Unity check | 0,01 | - |

**Note:** The unity check for torsion is lower than the limit value of 0,05. Therefore torsion is considered as insignificant and is ignored in the combined checks.

**Combined bending, axial force and shear force check**
According to EN 1993-1-1 article 6.2.9.1 and formula (6.41)

| | | |
|---|---|---|
| MN,y,Rd | 25,88 | kNm |
| Alpha | 2,17 | |
| MN,z,Rd | 25,88 | kNm |
| Beta | 2,17 | |

Unity check (6.41) = 0,02 + 0,01 = 0,03 -

**Note:** Since the shear forces are less than half the plastic shear resistances their effect on the moment resistances is neglected.

The member satisfies the section check.

**...::STABILITY CHECK::...**
**Classification for member buckling design**
Decisive position for stability classification: 2,403 m
**Classification of Internal Compression parts**
According to EN 1993-1-1 Table 5.2 Sheet 1

| | |
|---|---|
| Maximum width-to-thickness ratio | 20,33 |
| Class 1 Limit | 33,00 |
| Class 2 Limit | 38,00 |
| Class 3 Limit | 47,36 |

=> Section classified as Class 1 for member buckling design

**Flexural Buckling check**
According to EN 1993-1-1 article 6.3.1.1 and formula (6.46)

| Buckling parameters | yy | zz | |
|---|---|---|---|
| Sway type | sway | non-sway | |
| System length L | 4,806 | 4,806 | m |
| Buckling factor k | 0,90 | 0,90 | |
| Buckling length Lcr | 4,326 | 4,326 | m |
| Critical Euler load Ncr | 1019,60 | 1019,60 | kN |
| Slenderness Lambda | 79,68 | 79,68 | |
| Relative slenderness Lambda,rel | 0,85 | 0,85 | |
| Limit slenderness Lambda,rel,0 | 0,20 | 0,20 | |
| Buckling curve | c | c | |
| Imperfection Alpha | 0,49 | 0,49 | |
| Reduction factor Chi | 0,63 | 0,63 | |
| Buckling resistance Nb,Rd | 463,69 | 463,69 | kN |

| Flexural Buckling verification | | |
|---|---|---|
| Cross-section area A | 3,1230e-03 | $m^2$ |
| Buckling resistance Nb,Rd | 463,69 | kN |
| Unity check | 0,72 | - |

**Torsional(-Flexural) Buckling check**
According to EN 1993-1-1 article 6.3.1.1 and formula (6.46)
**Note:** The cross-section concerns a RHS section which is not susceptible to Torsional(-Flexural) Buckling.

**Lateral Torsional Buckling check**
According to EN 1993-1-1 article 6.3.2.1
**Note:** The cross-section concerns an RHS section with 'h / b < 10 / Lambda,rel,z'.
This section is thus not susceptible to Lateral Torsional Buckling.

**Bending and axial compression check**
According to EN 1993-1-1 article 6.3.3 and formula (6.61),(6.62)

| Bending and axial compression check parameters | | |
|---|---|---|
| Interaction method | alternative method 1 | |
| Cross-section area A | 3,1230e-03 | $m^2$ |
| Cross-section plastic modulus Wpl,y | 1,5533e-04 | $m^3$ |
| Cross-section plastic modulus Wpl,z | 1,5533e-04 | $m^3$ |
| Design compression force N,Ed | 333,80 | kN |
| Design bending moment (maximum) My,Ed | 5,23 | kNm |
| Design bending moment (maximum) Mz,Ed | -4,40 | kNm |
| Characteristic compression resistance N,Rk | 733,90 | kN |
| Characteristic moment resistance My,Rk | 36,50 | kNm |
| Characteristic moment resistance Mz,Rk | 36,50 | kNm |

| Bending and axial compression check parameters | | |
|---|---|---|
| Reduction factor Chi,y | 0,63 | |
| Reduction factor Chi,z | 0,63 | |
| Reduction factor Chi,LT | 1,00 | |
| Interaction factor k,yy | 0,98 | |
| Interaction factor k,yz | 0,60 | |
| Interaction factor k,zy | 0,67 | |
| Interaction factor k,zz | 0,90 | |

Maximum moment My,Ed is derived from beam B334 position 6,008 m.
Maximum moment Mz,Ed is derived from beam B334 position 0,000 m.

| Interaction method 1 parameters | | |
|---|---|---|
| Critical Euler load N,cr,y | 1019,60 | kN |
| Critical Euler load N,cr,z | 1019,60 | kN |
| Elastic critical load N,cr,T | 203036,57 | kN |
| Cross-section plastic modulus Wpl,y | 1,5533e-04 | $m^3$ |
| Cross-section elastic modulus Wel,y | 1,3149e-04 | $m^3$ |
| Cross-section plastic modulus Wpl,z | 1,5533e-04 | $m^3$ |
| Cross-section elastic modulus Wel,z | 1,3149e-04 | $m^3$ |
| Second moment of area Iy | 9,2043e-06 | $m^4$ |
| Second moment of area Iz | 9,2043e-06 | $m^4$ |
| Torsional constant It | 1,4788e-05 | $m^4$ |
| Method for equivalent moment factor C,my,0 | Table A.2 Line 2 (General) | |
| Design bending moment (maximum) My,Ed | 5,23 | kNm |
| Maximum relative deflection delta,z | -2,8 | mm |
| Equivalent moment factor C,my,0 | 0,82 | |
| Method for equivalent moment factor C,mz,0 | Table A.2 Line 2 (General) | |
| Design bending moment (maximum) Mz,Ed | -4,40 | kNm |
| Maximum relative deflection delta,y | -1,4 | mm |
| Equivalent moment factor C,mz,0 | 0,76 | |
| Factor mu,y | 0,85 | |
| Factor mu,z | 0,85 | |
| Factor epsilon,y | 0,37 | |
| Factor a,LT | 0,00 | |
| Critical moment for uniform bending Mcr,0 | 994,19 | kNm |
| Relative slenderness Lambda,rel,0 | 0,19 | |
| Limit relative slenderness Lambda,rel,0,lim | 0,20 | |
| Equivalent moment factor C,my | 0,82 | |
| Equivalent moment factor C,mz | 0,76 | |
| Equivalent moment factor C,mLT | 1,00 | |
| Factor b,LT | 0,00 | |
| Factor c,LT | 0,00 | |
| Factor d,LT | 0,00 | |
| Factor e,LT | 0,00 | |
| Factor w,y | 1,18 | |
| Factor w,z | 1,18 | |
| Factor n,pl | 0,45 | |
| Maximum relative slenderness Lambda,rel,max | 0,85 | |
| Factor C,yy | 1,05 | |
| Factor C,yz | 0,96 | |
| Factor C,zy | 0,92 | |
| Factor C,zz | 1,06 | |

Unity check (6.61) = 0,72 + 0,14 + 0,07 = 0,93 -
Unity check (6.62) = 0,72 + 0,10 + 0,11 = 0,92 -

The member satisfies the stability check.

# 6. Dimenzioniranje gornjeg pojasa rešetke pozicije R5

Linear calculation, Extreme : Global
Selection : All
Combinations : GSN2
Cross-section : G_Pojas5 - CFRHS140X140X10

**EN 1993-1-1 Code Check**
National annex: Standard EN

| | | | | | |
|---|---|---|---|---|---|
| **Member B33** | **11,261 m** | **CFRHS140X140X10** | **S 235** | **GSN2/1** | **0,98 -** |

Note: EN 1993-1-3 article 1.1(3) specifies that this part does not apply to cold formed CHS and RHS sections.
The default EN 1993-1-1 code check is executed instead of the EN 1993-1-3 code check.

| Partial safety factors | |
|---|---|
| Gamma M0 for resistance of cross-sections | 1,00 |
| Gamma M1 for resistance to instability | 1,00 |
| Gamma M2 for resistance of net sections | 1,25 |

| Material | | |
|---|---|---|
| Yield strength fy | 235,0 | MPa |
| Ultimate strength fu | 360,0 | MPa |

| Material | | |
|---|---|---|
| Fabrication | Cold formed | |

**..::SECTION CHECK::..**

**Classification for cross-section design**
According to EN 1993-1-1 article 5.5.2
**Classification of Internal Compression parts**
According to EN 1993-1-1 Table 5.2 Sheet 1

| | |
|---|---|
| Maximum width-to-thickness ratio | 11,00 |
| Class 1 Limit | 33,00 |
| Class 2 Limit | 38,00 |
| Class 3 Limit | 49,03 |

=> Section classified as Class 1 for cross-section design

**The critical check is on position 6.456 m**

| Internal forces | Calculated | Unit |
|---|---|---|
| N,Ed | -716,91 | kN |
| Vy,Ed | 6,03 | kN |
| Vz,Ed | 26,74 | kN |
| T,Ed | 0,61 | kNm |
| My,Ed | -7,08 | kNm |
| Mz,Ed | -7,62 | kNm |

**Compression check**
According to EN 1993-1-1 article 6.2.4 and formula (6.9)

| | | |
|---|---|---|
| A | 4,8570e-03 | $m^2$ |
| Nc,Rd | 1141,40 | kN |
| Unity check | 0,63 | - |

**Bending moment check for My**
According to EN 1993-1-1 article 6.2.5 and formula (6.12),(6.13)

| | | |
|---|---|---|
| Wpl,y | 2,3038e-04 | $m^3$ |
| Mpl,y,Rd | 54,14 | kNm |
| Unity check | 0,13 | - |

**Bending moment check for Mz**
According to EN 1993-1-1 article 6.2.5 and formula (6.12),(6.13)

| | | |
|---|---|---|
| Wpl,z | 2,3038e-04 | $m^3$ |
| Mpl,z,Rd | 54,14 | kNm |
| Unity check | 0,14 | - |

**Shear check for Vy**
According to EN 1993-1-1 article 6.2.6 and formula (6.17)

| | | |
|---|---|---|
| Eta | 1,20 | |
| Av | 2,4285e-03 | $m^2$ |
| Vpl,y,Rd | 329,49 | kN |
| Unity check | 0,02 | - |

**Shear check for Vz**
According to EN 1993-1-1 article 6.2.6 and formula (6.17)

| | | |
|---|---|---|
| Eta | 1,20 | |
| Av | 2,4285e-03 | $m^2$ |
| Vpl,z,Rd | 329,49 | kN |
| Unity check | 0,08 | - |

**Torsion check**
According to EN 1993-1-1 article 6.2.7 and formula (6.23)

| | | |
|---|---|---|
| Tau,t,Ed | 1,8 | MPa |
| Tau,Rd | 135,7 | MPa |
| Unity check | 0,01 | - |

**Note:** The unity check for torsion is lower than the limit value of 0,05. Therefore torsion is considered as insignificant and is ignored in the combined checks.

**Combined bending, axial force and shear force check**
According to EN 1993-1-1 article 6.2.9.1 and formula (6.41)

| | | |
|---|---|---|
| MN,y,Rd | 25,54 | kNm |
| Alpha | 3,00 | |
| MN,z,Rd | 25,54 | kNm |
| Beta | 3,00 | |

Unity check (6.41) = 0,02 + 0,03 = 0,05 -

**Note:** Since the shear forces are less than half the plastic shear resistances their effect on the moment resistances is neglected.

The member satisfies the section check.

**...::STABILITY CHECK::...**

**Classification for member buckling design**

Decisive position for stability classification: 6,456 m

**Classification of Internal Compression parts**

According to EN 1993-1-1 Table 5.2 Sheet 1

| | |
|---|---|
| Maximum width-to-thickness ratio | 11,00 |
| Class 1 Limit | 33,00 |
| Class 2 Limit | 38,00 |
| Class 3 Limit | 49,03 |

=> Section classified as Class 1 for member buckling design

**Flexural Buckling check**

According to EN 1993-1-1 article 6.3.1.1 and formula (6.46)

| Buckling parameters | yy | zz | |
|---|---|---|---|
| Sway type | sway | non-sway | |
| System length L | 2,402 | 2,402 | m |
| Buckling factor k | 1,00 | 1,00 | |
| Buckling length Lcr | 2,402 | 2,402 | m |
| Critical Euler load Ncr | 4710,73 | 4710,73 | kN |
| Slenderness Lambda | 46,23 | 46,23 | |
| Relative slenderness Lambda,rel | 0,49 | 0,49 | |
| Limit slenderness Lambda,rel,0 | 0,20 | 0,20 | |
| Buckling curve | c | c | |
| Imperfection Alpha | 0,49 | 0,49 | |
| Reduction factor Chi | 0,85 | 0,85 | |
| Buckling resistance Nb,Rd | 967,13 | 967,13 | kN |

| Flexural Buckling verification | | |
|---|---|---|
| Cross-section area A | 4,8570e-03 | $m^2$ |
| Buckling resistance Nb,Rd | 967,13 | kN |
| Unity check | 0,74 | - |

**Torsional(-Flexural) Buckling check**

According to EN 1993-1-1 article 6.3.1.1 and formula (6.46)

**Note:** The cross-section concerns a RHS section which is not susceptible to Torsional(-Flexural) Buckling.

**Lateral Torsional Buckling check**

According to EN 1993-1-1 article 6.3.2.1

**Note:** The cross-section concerns an RHS section with 'h / b < 10 / Lambda,rel,z'.

This section is thus not susceptible to Lateral Torsional Buckling.

**Bending and axial compression check**

According to EN 1993-1-1 article 6.3.3 and formula (6.61),(6.62)

| Bending and axial compression check parameters | | |
|---|---|---|
| Interaction method | alternative method 1 | |
| Cross-section area A | 4,8570e-03 | $m^2$ |
| Cross-section plastic modulus Wpl,y | 2,3038e-04 | $m^3$ |
| Cross-section plastic modulus Wpl,z | 2,3038e-04 | $m^3$ |
| Design compression force N,Ed | 716,91 | kN |
| Design bending moment (maximum) My,Ed | 9,34 | kNm |
| Design bending moment (maximum) Mz,Ed | -7,62 | kNm |
| Characteristic compression resistance N,Rk | 1141,40 | kN |
| Characteristic moment resistance My,Rk | 54,14 | kNm |
| Characteristic moment resistance Mz,Rk | 54,14 | kNm |
| Reduction factor Chi,y | 0,85 | |
| Reduction factor Chi,z | 0,85 | |
| Reduction factor Chi,LT | 1,00 | |
| Interaction factor k,yy | 0,98 | |
| Interaction factor k,yz | 0,52 | |
| Interaction factor k,zy | 0,61 | |
| Interaction factor k,zz | 0,85 | |

Maximum moment My,Ed is derived from beam B33 position 7,657 m.
Maximum moment Mz,Ed is derived from beam B33 position 0,000 m.

| Interaction method 1 parameters | | |
|---|---|---|
| Critical Euler load N,cr,y | 4710,73 | kN |
| Critical Euler load N,cr,z | 4710,73 | kN |
| Elastic critical load N,cr,T | 343020,78 | kN |
| Cross-section plastic modulus Wpl,y | 2,3038e-04 | $m^3$ |
| Cross-section elastic modulus Wel,y | 1,8738e-04 | $m^3$ |
| Cross-section plastic modulus Wpl,z | 2,3038e-04 | $m^3$ |
| Cross-section elastic modulus Wel,z | 1,8738e-04 | $m^3$ |
| Second moment of area Iy | 1,3117e-05 | $m^4$ |
| Second moment of area Iz | 1,3117e-05 | $m^4$ |
| Torsional constant It | 2,2739e-05 | $m^4$ |
| Method for equivalent moment factor C,my,0 | Table A.2 Line 2 (General) | |
| Design bending moment (maximum) My,Ed | 9,34 | kNm |

| Interaction method 1 parameters | | |
|---|---|---|
| Maximum relative deflection delta,z | -1,8 | mm |
| Equivalent moment factor C,my,0 | 0,99 | |
| Method for equivalent moment factor C,mz,0 | Table A.2 Line 2 (General) | |
| Design bending moment (maximum) Mz,Ed | -7,62 | kNm |
| Maximum relative deflection delta,y | 0,3 | mm |
| Equivalent moment factor C,mz,0 | 0,87 | |
| Factor mu,y | 0,97 | |
| Factor mu,z | 0,97 | |
| Factor epsilon,y | 0,34 | |
| Factor a,LT | 0,00 | |
| Critical moment for uniform bending Mcr,0 | 2954,25 | kNm |
| Relative slenderness Lambda,rel,0 | 0,14 | |
| Limit relative slenderness Lambda,rel,0,lim | 0,21 | |
| Equivalent moment factor C,my | 0,99 | |
| Equivalent moment factor C,mz | 0,87 | |
| Equivalent moment factor C,mLT | 1,00 | |
| Factor b,LT | 0,00 | |
| Factor c,LT | 0,00 | |
| Factor d,LT | 0,00 | |
| Factor e,LT | 0,00 | |
| Factor w,y | 1,23 | |
| Factor w,z | 1,23 | |
| Factor n,pl | 0,63 | |
| Maximum relative slenderness Lambda,rel,max | 0,49 | |
| Factor C,yy | 1,15 | |
| Factor C,yz | 1,16 | |
| Factor C,zy | 1,12 | |
| Factor C,zz | 1,18 | |

Unity check (6.61) = 0,74 + 0,17 + 0,07 = 0,98 -
Unity check (6.62) = 0,74 + 0,11 + 0,12 = 0,97 -

The member satisfies the stability check.

# 7. Dimenzioniranje donjeg pojasa rešetke pozicije R1

Linear calculation, Extreme : Global
Selection : All
Combinations : GSN1
Cross-section : D_Pojas1 - CFRHS140X140X4

**EN 1993-1-1 Code Check**
National annex: Standard EN

| Member B981 | 24,725 m | CFRHS140X140X4 | S 235 | GSN1/2 | 0,59 - |
|---|---|---|---|---|---|

Note: EN 1993-1-3 article 1.1(3) specifies that this part does not apply to cold formed CHS and RHS sections.
The default EN 1993-1-1 code check is executed instead of the EN 1993-1-3 code check.

| Partial safety factors | |
|---|---|
| Gamma M0 for resistance of cross-sections | 1,00 |
| Gamma M1 for resistance to instability | 1,00 |
| Gamma M2 for resistance of net sections | 1,25 |

| Material | | |
|---|---|---|
| Yield strength fy | 235,0 | MPa |
| Ultimate strength fu | 360,0 | MPa |
| Fabrication | Cold formed | |

**...::SECTION CHECK::...**

**Classification for cross-section design**
According to EN 1993-1-1 article 5.5.2
**Classification of Internal Compression parts**
According to EN 1993-1-1 Table 5.2 Sheet 1

| | |
|---|---|
| Maximum width-to-thickness ratio | 32,00 |
| Class 1 Limit | 96,92 |
| Class 2 Limit | 111,73 |
| Class 3 Limit | 217,15 |

=> Section classified as Class 1 for cross-section design

**The critical check is on position 20.850 m**

| Internal forces | Calculated | Unit |
|---|---|---|
| N,Ed | 90,05 | kN |
| Vy,Ed | -0,15 | kN |
| Vz,Ed | -19,40 | kN |
| T,Ed | 0,06 | kNm |
| My,Ed | 14,95 | kNm |
| Mz,Ed | 0,41 | kNm |

**Tension check**
According to EN 1993-1-1 article 6.2.3 and formula (6.5)

| | | |
|---|---|---|
| A | 2,1350e-03 | $m^2$ |
| Npl,Rd | 501,73 | kN |
| Nu,Rd | 553,39 | kN |
| Nt,Rd | 501,73 | kN |
| Unity check | 0,18 | - |

**Bending moment check for My**
According to EN 1993-1-1 article 6.2.5 and formula (6.12),(6.13)

| | | |
|---|---|---|
| Wpl,y | 1,0815e-04 | $m^3$ |
| Mpl,y,Rd | 25,42 | kNm |
| Unity check | 0,59 | - |

**Bending moment check for Mz**
According to EN 1993-1-1 article 6.2.5 and formula (6.12),(6.13)

| | | |
|---|---|---|
| Wpl,z | 1,0815e-04 | $m^3$ |
| Mpl,z,Rd | 25,42 | kNm |
| Unity check | 0,02 | - |

**Shear check for Vy**
According to EN 1993-1-1 article 6.2.6 and formula (6.17)

| | | |
|---|---|---|
| Eta | 1,20 | |
| Av | 1,0675e-03 | $m^2$ |
| Vpl,y,Rd | 144,84 | kN |
| Unity check | 0,00 | - |

**Shear check for Vz**
According to EN 1993-1-1 article 6.2.6 and formula (6.17)

| | | |
|---|---|---|
| Eta | 1,20 | |
| Av | 1,0675e-03 | $m^2$ |
| Vpl,z,Rd | 144,84 | kN |
| Unity check | 0,13 | - |

**Torsion check**
According to EN 1993-1-1 article 6.2.7 and formula (6.23)

| | | |
|---|---|---|
| Tau,t,Fd | 0,4 | MPa |
| Tau,Rd | 135,7 | MPa |
| Unity check | 0,00 | - |

**Note:** The unity check for torsion is lower than the limit value of 0,05. Therefore torsion is considered as insignificant and is ignored in the combined checks.

**Combined bending, axial force and shear force check**
According to EN 1993-1-1 article 6.2.9.1 and formula (6.41)

| | | |
|---|---|---|
| MN,y,Rd | 25,42 | kNm |
| Alpha | 1,72 | |
| MN,z,Rd | 25,42 | kNm |
| Beta | 1,72 | |

Unity check (6.41) = 0,40 + 0,00 = 0,40 -

**Note:** Since the shear forces are less than half the plastic shear resistances their effect on the moment resistances is neglected.

The member satisfies the section check.

**...::STABILITY CHECK::...**
**Classification for member buckling design**
Decisive position for stability classification: 20,850 m
**Classification of Internal Compression parts**
According to EN 1993-1-1 Table 5.2 Sheet 1

| | |
|---|---|
| Maximum width-to-thickness ratio | 32,00 |
| Class 1 Limit | 96,92 |
| Class 2 Limit | 111,73 |
| Class 3 Limit | 217,15 |

=> Section classified as Class 1 for member buckling design

**Lateral Torsional Buckling check**
According to EN 1993-1-1 article 6.3.2.1
**Note:** The cross-section concerns an RHS section with 'h / b < 10 / Lambda,rel,z'.
This section is thus not susceptible to Lateral Torsional Buckling.

**Bending and axial tension check**
According to EN 1993-1-3 article 6.3

| | | |
|---|---|---|
| Design tension force N,Ed | 90,05 | kN |
| Design bending moment My,Ed | 14,95 | kNm |
| Design bending moment Mz,Ed | 0,41 | kNm |

| | | |
|---|---|---|
| Tension resistance Nt,Rd | 501,73 | kN |
| Bending resistance Mb,y,Rd | 25,42 | kNm |
| Bending resistance Mc,z,Rd,com | 25,42 | kNm |

Unity check = 0,59 + 0,02 - 0,18 = 0,42 -

The member satisfies the stability check.

# 8. Dimenzioniranje donjeg pojasa rešetke pozicije R2

Linear calculation, Extreme : Global
Selection : All
Combinations : GSN1
Cross-section : D_Pojas2 - CFRHS140X140X7.1

**EN 1993-1-1 Code Check**
National annex: Standard EN

| | | | | | |
|---|---|---|---|---|---|
| **Member B356** | **24,725 m** | **CFRHS140X140X7.1** | **S 235** | **GSN1/2** | **0,88 -** |

Note: EN 1993-1-3 article 1.1(3) specifies that this part does not apply to cold formed CHS and RHS sections.
The default EN 1993-1-1 code check is executed instead of the EN 1993-1-3 code check.

| Partial safety factors | |
|---|---|
| Gamma M0 for resistance of cross-sections | 1,00 |
| Gamma M1 for resistance to instability | 1,00 |
| Gamma M2 for resistance of net sections | 1,25 |

| Material | | |
|---|---|---|
| Yield strength fy | 235,0 | MPa |
| Ultimate strength fu | 360,0 | MPa |
| Fabrication | Cold formed | |

**...::SECTION CHECK::...**

**Classification for cross-section design**
According to EN 1993-1-1 article 5.5.2
**Classification of Internal Compression parts**
According to EN 1993-1-1 Table 5.2 Sheet 1

| | |
|---|---|
| Maximum width-to-thickness ratio | 16,72 |
| Class 1 Limit | 95,43 |
| Class 2 Limit | 110,01 |
| Class 3 Limit | 211,16 |

=> Section classified as Class 1 for cross-section design

**The critical check is on position 20.850 m**

| Internal forces | Calculated | Unit |
|---|---|---|
| N,Ed | 214,98 | kN |
| Vy,Ed | -0,39 | kN |
| Vz,Ed | -46,49 | kN |
| T,Ed | 0,07 | kNm |
| My,Ed | 36,49 | kNm |
| Mz,Ed | 1,20 | kNm |

**Tension check**
According to EN 1993-1-1 article 6.2.3 and formula (6.5)

| | | |
|---|---|---|
| A | 3,6010e-03 | $m^2$ |
| Npl,Rd | 846,24 | kN |
| Nu,Rd | 933,38 | kN |
| Nt,Rd | 846,24 | kN |
| Unity check | 0,25 | - |

**Bending moment check for My**
According to EN 1993-1-1 article 6.2.5 and formula (6.12),(6.13)

| | | |
|---|---|---|
| Wpl,y | 1,7627e-04 | $m^3$ |
| Mpl,y,Rd | 41,42 | kNm |
| Unity check | 0,88 | - |

**Bending moment check for Mz**
According to EN 1993-1-1 article 6.2.5 and formula (6.12),(6.13)

| | | |
|---|---|---|
| Wpl,z | 1,7627e-04 | $m^3$ |
| Mpl,z,Rd | 41,42 | kNm |
| Unity check | 0,03 | - |

**Shear check for Vy**
According to EN 1993-1-1 article 6.2.6 and formula (6.17)

| | | |
|---|---|---|
| Eta | 1,20 | |
| Av | 1,8005e-03 | $m^2$ |
| Vpl,y,Rd | 244,29 | kN |
| Unity check | 0,00 | - |

**Shear check for Vz**
According to EN 1993-1-1 article 6.2.6 and formula (6.17)

| | | |
|---|---|---|
| Eta | 1,20 | |
| Av | 1,8005e-03 | $m^2$ |
| Vpl,z,Rd | 244,29 | kN |
| Unity check | 0,19 | - |

**Torsion check**
According to EN 1993-1-1 article 6.2.7 and formula (6.23)

| | | |
|---|---|---|
| Tau,t,Ed | 0,3 | MPa |
| Tau,Rd | 135,7 | MPa |
| Unity check | 0,00 | - |

**Note:** The unity check for torsion is lower than the limit value of 0,05. Therefore torsion is considered as insignificant and is ignored in the combined checks.

**Combined bending, axial force and shear force check**
According to EN 1993-1-1 article 6.2.9.1 and formula (6.41)

| | | |
|---|---|---|
| MN,y,Rd | 39,82 | kNm |
| Alpha | 1,79 | |
| MN,z,Rd | 39,82 | kNm |
| Beta | 1,79 | |

Unity check (6.41) = 0,86 + 0,00 = 0,86 -

**Note:** Since the shear forces are less than half the plastic shear resistances their effect on the moment resistances is neglected.

The member satisfies the section check.

**...::STABILITY CHECK::...**
**Classification for member buckling design**
Decisive position for stability classification: 20,850 m
**Classification of Internal Compression parts**
According to EN 1993-1-1 Table 5.2 Sheet 1

| | |
|---|---|
| Maximum width-to-thickness ratio | 16,72 |
| Class 1 Limit | 95,43 |
| Class 2 Limit | 110,01 |
| Class 3 Limit | 211,16 |

=> Section classified as Class 1 for member buckling design

**Lateral Torsional Buckling check**
According to EN 1993-1-1 article 6.3.2.1
**Note:** The cross-section concerns an RHS section with 'h / b < 10 / Lambda,rel,z'.
This section is thus not susceptible to Lateral Torsional Buckling.

**Bending and axial tension check**
According to EN 1993-1-3 article 6.3

| | | |
|---|---|---|
| Design tension force N,Ed | 214,98 | kN |
| Design bending moment My,Ed | 36,49 | kNm |
| Design bending moment Mz,Ed | 1,20 | kNm |
| Tension resistance Nt,Rd | 846,24 | kN |
| Bending resistance Mb,y,Rd | 41,42 | kNm |
| Bending resistance Mc,z,Rd,com | 41,42 | kNm |

Unity check = 0,88 + 0,03 - 0,25 = 0,66 -

The member satisfies the stability check.

# 9. Dimenzioniranje donjeg pojasa rešetke pozicije R3

Linear calculation, Extreme : Global
Selection : All
Combinations : GSN1
Cross-section : D_Pojas3 - CFRHS140X140X10

**EN 1993-1-1 Code Check**
National annex: Standard EN

| | | | | | |
|---|---|---|---|---|---|
| **Member B531** | **24,725 m** | **CFRHS140X140X10** | **S 235** | **GSN1/2** | **0,81 -** |

Note: EN 1993-1-3 article 1.1(3) specifies that this part does not apply to cold formed CHS and RHS sections.
The default EN 1993-1-1 code check is executed instead of the EN 1993-1-3 code check.

| Partial safety factors | |
|---|---|
| Gamma M0 for resistance of cross-sections | 1,00 |
| Gamma M1 for resistance to instability | 1,00 |
| Gamma M2 for resistance of net sections | 1,25 |

| Material | | |
|---|---|---|
| Yield strength fy | 235,0 | MPa |
| Ultimate strength fu | 360,0 | MPa |
| Fabrication | Cold formed | |

**...::SECTION CHECK::...**

**Classification for cross-section design**
According to EN 1993-1-1 article 5.5.2
**Classification of Internal Compression parts**
According to EN 1993-1-1 Table 5.2 Sheet 1

| | |
|---|---|
| Maximum width-to-thickness ratio | 11,00 |
| Class 1 Limit | 100,98 |
| Class 2 Limit | 116,41 |
| Class 3 Limit | 233,65 |

=> Section classified as Class 1 for cross-section design

**The critical check is on position 20.850 m**

| Internal forces | Calculated | Unit |
|---|---|---|
| N,Ed | 268,26 | kN |
| Vy,Ed | -0,18 | kN |
| Vz,Ed | -57,30 | kN |
| T,Ed | 0,14 | kNm |
| My,Ed | 43,70 | kNm |
| Mz,Ed | 0,49 | kNm |

**Tension check**
According to EN 1993-1-1 article 6.2.3 and formula (6.5)

| | | |
|---|---|---|
| A | 4,8570e-03 | $m^2$ |
| Npl,Rd | 1141,40 | kN |
| Nu,Rd | 1258,93 | kN |
| Nt,Rd | 1141,40 | kN |
| Unity check | 0,24 | - |

**Bending moment check for My**
According to EN 1993-1-1 article 6.2.5 and formula (6.12),(6.13)

| | | |
|---|---|---|
| Wpl,y | 2,3038e-04 | $m^3$ |
| Mpl,y,Rd | 54,14 | kNm |
| Unity check | 0,81 | - |

**Bending moment check for Mz**
According to EN 1993-1-1 article 6.2.5 and formula (6.12),(6.13)

| | | |
|---|---|---|
| Wpl,z | 2,3038e-04 | $m^3$ |
| Mpl,z,Rd | 54,14 | kNm |
| Unity check | 0,01 | - |

**Shear check for Vy**
According to EN 1993-1-1 article 6.2.6 and formula (6.17)

| | | |
|---|---|---|
| Eta | 1,20 | |
| Av | 2,4285e-03 | $m^2$ |
| Vpl,y,Rd | 329,49 | kN |
| Unity check | 0,00 | - |

**Shear check for Vz**
According to EN 1993-1-1 article 6.2.6 and formula (6.17)

| | | |
|---|---|---|
| Eta | 1,20 | |
| Av | 2,4285e-03 | $m^2$ |
| Vpl,z,Rd | 329,49 | kN |
| Unity check | 0,17 | - |

**Torsion check**
According to EN 1993-1-1 article 6.2.7 and formula (6.23)

| | | |
|---|---|---|
| Tau,t,Ed | 0,4 | MPa |
| Tau,Rd | 135,7 | MPa |
| Unity check | 0,00 | - |

**Note:** The unity check for torsion is lower than the limit value of 0,05. Therefore torsion is considered as insignificant and is ignored in the combined checks.

**Combined bending, axial force and shear force check**
According to EN 1993-1-1 article 6.2.9.1 and formula (6.41)

| | | |
|---|---|---|
| MN,y,Rd | 52,54 | kNm |
| Alpha | 1,77 | |
| MN,z,Rd | 52,54 | kNm |
| Beta | 1,77 | |

Unity check (6.41) = 0,72 + 0,00 = 0,72 -

**Note:** Since the shear forces are less than half the plastic shear resistances their effect on the moment resistances is neglected.

The member satisfies the section check.

**...::STABILITY CHECK::...**

**Classification for member buckling design**

Decisive position for stability classification: 20,850 m

**Classification of Internal Compression parts**

According to EN 1993-1-1 Table 5.2 Sheet 1

| | |
|---|---|
| Maximum width-to-thickness ratio | 11,00 |
| Class 1 Limit | 100,98 |
| Class 2 Limit | 116,41 |
| Class 3 Limit | 233,65 |

=> Section classified as Class 1 for member buckling design

**Lateral Torsional Buckling check**

According to EN 1993-1-1 article 6.3.2.1

**Note:** The cross-section concerns an RHS section with 'h / b < 10 / Lambda,rel,z'.

This section is thus not susceptible to Lateral Torsional Buckling.

**Bending and axial tension check**

According to EN 1993-1-3 article 6.3

| | | |
|---|---|---|
| Design tension force N,Ed | 268,26 | kN |
| Design bending moment My,Ed | 43,70 | kNm |
| Design bending moment Mz,Ed | 0,49 | kNm |
| Tension resistance Nt,Rd | 1141,40 | kN |
| Bending resistance Mb,y,Rd | 54,14 | kNm |
| Bending resistance Mc,z,Rd,com | 54,14 | kNm |

Unity check = 0,81 + 0,01 - 0,24 = 0,58 -

The member satisfies the stability check.

# 10. Dimenzioniranje donjeg pojasa rešetke pozicije R4

Linear calculation, Extreme : Global

Selection : All

Combinations : GSN1

Cross-section : D Pojas4 - CFRHS140X140X8

**EN 1993-1-1 Code Check**

National annex: Standard EN

| | | | | | |
|---|---|---|---|---|---|
| **Member B131** | **24,725 m** | **CFRHS140X140X8** | **S 235** | **GSN1/2** | **0,85 -** |

Note: EN 1993-1-3 article 1.1(3) specifies that this part does not apply to cold formed CHS and RHS sections.

The default EN 1993-1-1 code check is executed instead of the EN 1993-1-3 code check.

| Partial safety factors | |
|---|---|
| Gamma M0 for resistance of cross-sections | 1,00 |
| Gamma M1 for resistance to instability | 1,00 |
| Gamma M2 for resistance of net sections | 1,25 |

| Material | | |
|---|---|---|
| Yield strength fy | 235,0 | MPa |
| Ultimate strength fu | 360,0 | MPa |
| Fabrication | Cold formed | |

**...::SECTION CHECK::...**

**Classification for cross-section design**

According to EN 1993-1-1 article 5.5.2

**Classification of Internal Compression parts**

According to EN 1993-1-1 Table 5.2 Sheet 1

| | |
|---|---|
| Maximum width-to-thickness ratio | 14,50 |
| Class 1 Limit | 105,14 |
| Class 2 Limit | 121,20 |
| Class 3 Limit | 250,93 |

=> Section classified as Class 1 for cross-section design

**The critical check is on position 20.850 m**

| Internal forces | Calculated | Unit |
|---|---|---|
| N,Ed | 229,84 | kN |
| Vy,Ed | 0,30 | kN |
| Vz,Ed | -49,72 | kN |
| T,Ed | 0,05 | kNm |
| My,Ed | 38,88 | kNm |
| Mz,Ed | -0,91 | kNm |

**Tension check**
According to EN 1993-1-1 article 6.2.3 and formula (6.5)

| | | |
|---|---|---|
| A | 4,0040e-03 | $m^2$ |
| Npl,Rd | 940,94 | kN |
| Nu,Rd | 1037,84 | kN |
| Nt,Rd | 940,94 | kN |
| Unity check | 0,24 | - |

**Bending moment check for My**
According to EN 1993-1-1 article 6.2.5 and formula (6.12),(6.13)

| | | |
|---|---|---|
| Wpl,y | 1,9418e-04 | $m^3$ |
| Mpl,y,Rd | 45,63 | kNm |
| Unity check | 0,85 | - |

**Bending moment check for Mz**
According to EN 1993-1-1 article 6.2.5 and formula (6.12),(6.13)

| | | |
|---|---|---|
| Wpl,z | 1,9418e-04 | $m^3$ |
| Mpl,z,Rd | 45,63 | kNm |
| Unity check | 0,02 | - |

**Shear check for Vy**
According to EN 1993-1-1 article 6.2.6 and formula (6.17)

| | | |
|---|---|---|
| Eta | 1,20 | |
| Av | 2,0020e-03 | $m^2$ |
| Vpl,y,Rd | 271,63 | kN |
| Unity check | 0,00 | - |

**Shear check for Vz**
According to EN 1993-1-1 article 6.2.6 and formula (6.17)

| | | |
|---|---|---|
| Eta | 1,20 | |
| Av | 2,0020e-03 | $m^2$ |
| Vpl,z,Rd | 271,63 | kN |
| Unity check | 0,18 | - |

**Torsion check**
According to EN 1993-1-1 article 6.2.7 and formula (6.23)

| | | |
|---|---|---|
| Tau,t,Fd | 0,2 | MPa |
| Tau,Rd | 135,7 | MPa |
| Unity check | 0,00 | - |

**Note:** The unity check for torsion is lower than the limit value of 0,05. Therefore torsion is considered as insignificant and is ignored in the combined checks.

**Combined bending, axial force and shear force check**
According to EN 1993-1-1 article 6.2.9.1 and formula (6.41)

| | | |
|---|---|---|
| MN,y,Rd | 44,23 | kNm |
| Alpha | 1,78 | |
| MN,z,Rd | 44,23 | kNm |
| Beta | 1,78 | |

Unity check (6.41) = 0,79 + 0,00 = 0,80 -

**Note:** Since the shear forces are less than half the plastic shear resistances their effect on the moment resistances is neglected.

The member satisfies the section check.

**...::STABILITY CHECK::...**
**Classification for member buckling design**
Decisive position for stability classification: 20,850 m
**Classification of Internal Compression parts**
According to EN 1993-1-1 Table 5.2 Sheet 1

| | |
|---|---|
| Maximum width-to-thickness ratio | 14,50 |
| Class 1 Limit | 105,14 |
| Class 2 Limit | 121,20 |
| Class 3 Limit | 250,93 |

=> Section classified as Class 1 for member buckling design

**Lateral Torsional Buckling check**
According to EN 1993-1-1 article 6.3.2.1
**Note:** The cross-section concerns an RHS section with 'h / b < 10 / Lambda,rel,z'.
This section is thus not susceptible to Lateral Torsional Buckling.

**Bending and axial tension check**
According to EN 1993-1-3 article 6.3

| | | |
|---|---|---|
| Design tension force N,Ed | 229,84 | kN |
| Design bending moment My,Ed | 38,88 | kNm |
| Design bending moment Mz,Ed | -0,91 | kNm |

| | | |
|---|---|---|
| Tension resistance Nt,Rd | 940,94 | kN |
| Bending resistance Mb,y,Rd | 45,63 | kNm |
| Bending resistance Mc,z,Rd,com | 45,63 | kNm |

Unity check = 0,85 + 0,02 - 0,24 = 0,63 -

The member satisfies the stability check.



# 11. Dimenzioniranje donjeg pojasa rešetke pozicije R5

Linear calculation, Extreme : Global
Selection : All
Combinations : GSN1
Cross-section : D_Pojas5 - CFRHS140X140X10

**EN 1993-1-1 Code Check**
National annex: Standard EN

| | | | | | |
|---|---|---|---|---|---|
| **Member B81** | **24,725 m** | **CFRHS140X140X10** | **S 235** | **GSN1/2** | **0,79 -** |

Note: EN 1993-1-3 article 1.1(3) specifies that this part does not apply to cold formed CHS and RHS sections.
The default EN 1993-1-1 code check is executed instead of the EN 1993-1-3 code check.

| Partial safety factors | |
|---|---|
| Gamma M0 for resistance of cross-sections | 1,00 |
| Gamma M1 for resistance to instability | 1,00 |
| Gamma M2 for resistance of net sections | 1,25 |

| Material | | |
|---|---|---|
| Yield strength fy | 235,0 | MPa |
| Ultimate strength fu | 360,0 | MPa |
| Fabrication | Cold formed | |

**...::SECTION CHECK::...**

**Classification for cross-section design**
According to EN 1993-1-1 article 5.5.2
**Classification of Internal Compression parts**
According to EN 1993-1-1 Table 5.2 Sheet 1

| | |
|---|---|
| Maximum width-to-thickness ratio | 11,00 |
| Class 1 Limit | 97,48 |
| Class 2 Limit | 112,37 |
| Class 3 Limit | 219,38 |

=> Section classified as Class 1 for cross-section design



**The critical check is on position 20.850 m**

| Internal forces | Calculated | Unit |
|---|---|---|
| N,Ed | 249,00 | kN |
| Vy,Ed | -0,26 | kN |
| Vz,Ed | -56,86 | kN |
| T,Ed | 0,13 | kNm |
| My,Ed | 42,77 | kNm |
| Mz,Ed | 0,82 | kNm |

**Tension check**
According to EN 1993-1-1 article 6.2.3 and formula (6.5)

| | | |
|---|---|---|
| A | 4,8570e-03 | $m^2$ |
| Npl,Rd | 1141,40 | kN |
| Nu,Rd | 1258,93 | kN |
| Nt,Rd | 1141,40 | kN |
| Unity check | 0,22 | - |

**Bending moment check for My**
According to EN 1993-1-1 article 6.2.5 and formula (6.12),(6.13)

| | | |
|---|---|---|
| Wpl,y | 2,3038e-04 | $m^3$ |
| Mpl,y,Rd | 54,14 | kNm |
| Unity check | 0,79 | - |

**Bending moment check for Mz**
According to EN 1993-1-1 article 6.2.5 and formula (6.12),(6.13)

| | | |
|---|---|---|
| Wpl,z | 2,3038e-04 | $m^3$ |
| Mpl,z,Rd | 54,14 | kNm |
| Unity check | 0,02 | - |

**Shear check for Vy**
According to EN 1993-1-1 article 6.2.6 and formula (6.17)

| | | |
|---|---|---|
| Eta | 1,20 | |
| Av | 2,4285e-03 | $m^2$ |
| Vpl,y,Rd | 329,49 | kN |
| Unity check | 0,00 | - |

**Shear check for Vz**
According to EN 1993-1-1 article 6.2.6 and formula (6.17)

| | | |
|---|---|---|
| Eta | 1,20 | |
| Av | 2,4285e-03 | $m^2$ |
| Vpl,z,Rd | 329,49 | kN |
| Unity check | 0,17 | - |



**Torsion check**
According to EN 1993-1-1 article 6.2.7 and formula (6.23)

| | | |
|---|---|---|
| Tau,t,Ed | 0,4 | MPa |
| Tau,Rd | 135,7 | MPa |
| Unity check | 0,00 | - |

**Note:** The unity check for torsion is lower than the limit value of 0,05. Therefore torsion is considered as insignificant and is ignored in the combined checks.

**Combined bending, axial force and shear force check**
According to EN 1993-1-1 article 6.2.9.1 and formula (6.41)

| | | |
|---|---|---|
| MN,y,Rd | 53,70 | kNm |
| Alpha | 1,75 | |
| MN,z,Rd | 53,70 | kNm |
| Beta | 1,75 | |

Unity check (6.41) = 0,67 + 0,00 = 0,67 -

**Note:** Since the shear forces are less than half the plastic shear resistances their effect on the moment resistances is neglected.

The member satisfies the section check.

**...::STABILITY CHECK::...**
**Classification for member buckling design**
Decisive position for stability classification: 20,850 m
**Classification of Internal Compression parts**
According to EN 1993-1-1 Table 5.2 Sheet 1

| | |
|---|---|
| Maximum width-to-thickness ratio | 11,00 |
| Class 1 Limit | 97,48 |
| Class 2 Limit | 112,37 |
| Class 3 Limit | 219,38 |

=> Section classified as Class 1 for member buckling design



**Lateral Torsional Buckling check**
According to EN 1993-1-1 article 6.3.2.1
**Note:** The cross-section concerns an RHS section with 'h / b < 10 / Lambda,rel,z'.
This section is thus not susceptible to Lateral Torsional Buckling.

**Bending and axial tension check**
According to EN 1993-1-3 article 6.3

| | | |
|---|---|---|
| Design tension force N,Ed | 249,00 | kN |
| Design bending moment My,Ed | 42,77 | kNm |
| Design bending moment Mz,Ed | 0,82 | kNm |
| Tension resistance Nt,Rd | 1141,40 | kN |
| Bending resistance Mb,y,Rd | 54,14 | kNm |
| Bending resistance Mc,z,Rd,com | 54,14 | kNm |

Unity check = 0,79 + 0,02 - 0,22 = 0,59 -

The member satisfies the stability check.

# 12. Dimenzioniranje ispune rešetke pozicije R1

Linear calculation, Extreme : Global
Selection : All
Combinations : GSN1
Cross-section : Ispuna1 - CFRHS90X90X4

**EN 1993-1-1 Code Check**
National annex: Standard EN

| | | | | | |
|---|---|---|---|---|---|
| **Member B368** | **2,581 m** | **CFRHS90X90X4** | **S 235** | **GSN1/2** | **0,76 -** |

Note: EN 1993-1-3 article 1.1(3) specifies that this part does not apply to cold formed CHS and RHS sections.
The default EN 1993-1-1 code check is executed instead of the EN 1993-1-3 code check.

| **Partial safety factors** | |
|---|---|
| Gamma M0 for resistance of cross-sections | 1,00 |
| Gamma M1 for resistance to instability | 1,00 |
| Gamma M2 for resistance of net sections | 1,25 |

| Material | | |
|---|---|---|
| Yield strength fy | 235,0 | MPa |
| Ultimate strength fu | 360,0 | MPa |
| Fabrication | Cold formed | |



**...::SECTION CHECK::...**

**Classification for cross-section design**
According to EN 1993-1-1 article 5.5.2
**Classification of Internal Compression parts**
According to EN 1993-1-1 Table 5.2 Sheet 1

| | |
|---|---|
| Maximum width-to-thickness ratio | 19,50 |
| Class 1 Limit | 33,00 |
| Class 2 Limit | 38,00 |
| Class 3 Limit | 42,00 |

=> Section classified as Class 1 for cross-section design

**The critical check is on position 0.000 m**

| Internal forces | Calculated | Unit |
|---|---|---|
| N,Ed | -159,47 | kN |
| Vy,Ed | 0,00 | kN |
| Vz,Ed | 0,00 | kN |
| T,Ed | 0,00 | kNm |
| My,Ed | 0,00 | kNm |
| Mz,Ed | 0,00 | kNm |

**Compression check**
According to EN 1993-1-1 article 6.2.4 and formula (6.9)

| | | |
|---|---|---|
| A | 1,3350e-03 | $m^2$ |
| Nc,Rd | 313,73 | kN |
| Unity check | 0,51 | - |

The member satisfies the section check.

**...::STABILITY CHECK::...**
**Classification for member buckling design**
Decisive position for stability classification: 0,000 m
**Classification of Internal Compression parts**
According to EN 1993-1-1 Table 5.2 Sheet 1



| | |
|---|---|
| Maximum width-to-thickness ratio | 19,50 |
| Class 1 Limit | 33,00 |
| Class 2 Limit | 38,00 |
| Class 3 Limit | 42,00 |

=> Section classified as Class 1 for member buckling design

**Flexural Buckling check**
According to EN 1993-1-1 article 6.3.1.1 and formula (6.46)

| Buckling parameters | yy | zz | |
|---|---|---|---|
| Sway type | sway | non-sway | |
| System length L | 2,581 | 2,581 | m |
| Buckling factor k | 1,00 | 1,00 | |
| Buckling length Lcr | 2,581 | 2,581 | m |
| Critical Euler load Ncr | 503,80 | 503,80 | kN |
| Slenderness Lambda | 74,11 | 74,11 | |
| Relative slenderness Lambda,rel | 0,79 | 0,79 | |
| Limit slenderness Lambda,rel,0 | 0,20 | 0,20 | |
| Buckling curve | c | c | |
| Imperfection Alpha | 0,49 | 0,49 | |
| Reduction factor Chi | 0,67 | 0,67 | |
| Buckling resistance Nb,Rd | 209,88 | 209,88 | kN |

| Flexural Buckling verification | | |
|---|---|---|
| Cross-section area A | 1,3350e-03 | $m^2$ |
| Buckling resistance Nb,Rd | 209,88 | kN |
| Unity check | 0,76 | - |

**Torsional(-Flexural) Buckling check**
According to EN 1993-1-1 article 6.3.1.1 and formula (6.46)
**Note:** The cross-section concerns a RHS section which is not susceptible to Torsional(-Flexural) Buckling.

The member satisfies the stability check.

# 13. Dimenzioniranje ispune rešetke pozicije R2

Linear calculation, Extreme : Global
Selection : Al
Combinations : GSN1
Cross-section : Ispuna2 - CFRHS90X90X5

**EN 1993-1-1 Code Check**
National annex: Standard EN

| | | | | | |
|---|---|---|---|---|---|
| **Member B361** | **2,557 m** | **CFRHS90X90X5** | **S 235** | **GSN1/2** | **0,84 -** |

Note: EN 1993-1-3 article 1.1(3) specifies that this part does not apply to cold formed CHS and RHS sections.
The default EN 1993-1-1 code check is executed instead of the EN 1993-1-3 code check.

| Partial safety factors | |
|---|---|
| Gamma M0 for resistance of cross-sections | 1,00 |
| Gamma M1 for resistance to instability | 1,00 |
| Gamma M2 for resistance of net sections | 1,25 |

| Material | | |
|---|---|---|
| Yield strength fy | 235,0 | MPa |
| Ultimate strength fu | 360,0 | MPa |
| Fabrication | Cold formed | |

**...::SECTION CHECK::...**

**Classification for cross-section design**
According to EN 1993-1-1 article 5.5.2
**Classification of Internal Compression parts**
According to EN 1993-1-1 Table 5.2 Sheet 1

| | |
|---|---|
| Maximum width-to-thickness ratio | 15,00 |
| Class 1 Limit | 33,00 |
| Class 2 Limit | 38,00 |
| Class 3 Limit | 42,00 |

=> Section classified as Class 1 for cross-section design

**The critical check is on position 2.557 m**

| Internal forces | Calculated | Unit |
|---|---|---|
| N,Ed | -215,95 | kN |
| Vy,Ed | 0,00 | kN |
| Vz,Ed | 0,00 | kN |
| T,Ed | 0,00 | kNm |
| My,Ed | 0,00 | kNm |
| Mz,Ed | 0,00 | kNm |

**Compression check**
According to EN 1993-1-1 article 6.2.4 and formula (6.9)

| | | |
|---|---|---|
| A | 1,6360e-03 | $m^2$ |
| Nc,Rd | 384,46 | kN |
| Unity check | 0,56 | - |

The member satisfies the section check.

**...::STABILITY CHECK::...**
**Classification for member buckling design**
Decisive position for stability classification: 0,000 m
**Classification of Internal Compression parts**
According to EN 1993-1-1 Table 5.2 Sheet 1

| | |
|---|---|
| Maximum width-to-thickness ratio | 15,00 |
| Class 1 Limit | 33,00 |
| Class 2 Limit | 38,00 |
| Class 3 Limit | 42,00 |

=> Section classified as Class 1 for member buckling design

**Flexural Buckling check**
According to EN 1993-1-1 article 6.3.1.1 and formula (6.46)

| Buckling parameters | yy | zz | |
|---|---|---|---|
| Sway type | sway | non-sway | |
| System length L | 2,557 | 2,557 | m |
| Buckling factor k | 1,00 | 1,00 | |
| Buckling length Lcr | 2,557 | 2,557 | m |
| Critical Euler load Ncr | 611,36 | 611,36 | kN |
| Slenderness Lambda | 74,47 | 74,47 | |
| Relative slenderness Lambda,rel | 0,79 | 0,79 | |
| Limit slenderness Lambda,rel,0 | 0,20 | 0,20 | |
| Buckling curve | c | c | |
| Imperfection Alpha | 0,49 | 0,49 | |
| Reduction factor Chi | 0,67 | 0,67 | |
| Buckling resistance Nb,Rd | 256,26 | 256,26 | kN |

| Flexural Buckling verification | | |
|---|---|---|
| Cross-section area A | 1,6360e-03 | $m^2$ |
| Buckling resistance Nb,Rd | 256,26 | kN |
| Unity check | 0,84 | - |

**Torsional(-Flexural) Buckling check**
According to EN 1993-1-1 article 6.3.1.1 and formula (6.46)
**Note:** The cross-section concerns a RHS section which is not susceptible to Torsional(-Flexural) Buckling.

The member satisfies the stability check.

# 14. Dimenzioniranje ispune rešetke pozicije R3

Linear calculation, Extreme : Global
Selection : All
Combinations : GSN1
Cross-section : Ispuna3 - CFRHS90X90X6

**EN 1993-1-1 Code Check**
National annex: Standard EN

| | | | | | |
|---|---|---|---|---|---|
| **Member B536** | **2,557 m** | **CFRHS90X90X6** | **S 235** | **GSN1/2** | **0,88 -** |

Note: EN 1993-1-3 article 1.1(3) specifies that this part does not apply to cold formed CHS and RHS sections.
The default EN 1993-1-1 code check is executed instead of the EN 1993-1-3 code check.

| Partial safety factors | |
|---|---|
| Gamma M0 for resistance of cross-sections | 1,00 |
| Gamma M1 for resistance to instability | 1,00 |
| Gamma M2 for resistance of net sections | 1,25 |

| Material | | |
|---|---|---|
| Yield strength fy | 235,0 | MPa |
| Ultimate strength fu | 360,0 | MPa |
| Fabrication | Cold formed | |

**...::SECTION CHECK::...**

**Classification for cross-section design**
According to EN 1993-1-1 article 5.5.2
**Classification of Internal Compression parts**
According to EN 1993-1-1 Table 5.2 Sheet 1

| | |
|---|---|
| Maximum width-to-thickness ratio | 12,00 |
| Class 1 Limit | 33,00 |
| Class 2 Limit | 38,00 |
| Class 3 Limit | 42,00 |

=> Section classified as Class 1 for cross-section design

**The critical check is on position 2.557 m**

| Internal forces | Calculated | Unit |
|---|---|---|
| N,Ed | -262,85 | kN |
| Vy,Ed | 0,00 | kN |
| Vz,Ed | 0,00 | kN |
| T,Ed | 0,00 | kNm |
| My,Ed | 0,00 | kNm |
| Mz,Ed | 0,00 | kNm |

**Compression check**
According to EN 1993-1-1 article 6.2.4 and formula (6.9)

| | | |
|---|---|---|
| A | 1,9230e-03 | $m^2$ |
| Nc,Rd | 451,90 | kN |
| Unity check | 0,58 | - |

The member satisfies the section check.

**...::STABILITY CHECK::...**
**Classification for member buckling design**
Decisive position for stability classification: 0,000 m
**Classification of Internal Compression parts**
According to EN 1993-1-1 Table 5.2 Sheet 1

| | |
|---|---|
| Maximum width-to-thickness ratio | 12,00 |
| Class 1 Limit | 33,00 |
| Class 2 Limit | 38,00 |
| Class 3 Limit | 42,00 |

=> Section classified as Class 1 for member buckling design

**Flexural Buckling check**
According to EN 1993-1-1 article 6.3.1.1 and formula (6.46)

| Buckling parameters | yy | zz | |
|---|---|---|---|
| Sway type | sway | non-sway | |
| System length L | 2,557 | 2,557 | m |
| Buckling factor k | 1,00 | 1,00 | |
| Buckling length Lcr | 2,557 | 2,557 | m |
| Critical Euler load Ncr | 698,67 | 698,67 | kN |
| Slenderness Lambda | 75,53 | 75,53 | |

| Buckling parameters | yy | zz | |
|---|---|---|---|
| Relative slenderness Lambda,rel | 0,80 | 0,80 | |
| Limit slenderness Lambda,rel,0 | 0,20 | 0,20 | |
| Buckling curve | c | c | |
| Imperfection Alpha | 0,49 | 0,49 | |
| Reduction factor Chi | 0,66 | 0,66 | |
| Buckling resistance Nb,Rd | 298,03 | 298,03 | kN |



| Flexural Buckling verification | | |
|---|---|---|
| Cross-section area A | 1,9230e-03 | $m^2$ |
| Buckling resistance Nb,Rd | 298,03 | kN |
| Unity check | 0,88 | - |

**Torsional(-Flexural) Buckling check**
According to EN 1993-1-1 article 6.3.1.1 and formula (6.46)
**Note:** The cross-section concerns a RHS section which is not susceptible to Torsional(-Flexural) Buckling.

The member satisfies the stability check.

# 15. Dimenzioniranje ispune rešetke pozicije R4

Linear calculation, Extreme : Global
Selection : All
Combinations : GSN1
Cross-section : Ispuna4 - CFRHS90X90X5

**EN 1993-1-1 Code Check**
National annex: Standard EN

| | | | | | |
|---|---|---|---|---|---|
| **Member B236** | **2,557 m** | **CFRHS90X90X5** | **S 235** | **GSN1/2** | **0,90 -** |

Note: EN 1993-1-3 article 1.1(3) specifies that this part does not apply to cold formed CHS and RHS sections.
The default EN 1993-1-1 code check is executed instead of the EN 1993-1-3 code check.

| Partial safety factors | |
|---|---|
| Gamma M0 for resistance of cross-sections | 1,00 |
| Gamma M1 for resistance to instability | 1,00 |
| Gamma M2 for resistance of net sections | 1,25 |

| Material | | |
|---|---|---|
| Yield strength fy | 235,0 | MPa |
| Ultimate strength fu | 360,0 | MPa |
| Fabrication | Cold formed | |



**...::SECTION CHECK::...**

**Classification for cross-section design**
According to EN 1993-1-1 article 5.5.2
**Classification of Internal Compression parts**
According to EN 1993-1-1 Table 5.2 Sheet 1

| | |
|---|---|
| Maximum width-to-thickness ratio | 15,00 |
| Class 1 Limit | 33,00 |
| Class 2 Limit | 38,00 |
| Class 3 Limit | 42,00 |

=> Section classified as Class 1 for cross-section design

**The critical check is on position 2.557 m**

| Internal forces | Calculated | Unit |
|---|---|---|
| N,Ed | -229,86 | kN |
| Vy,Ed | 0,00 | kN |
| Vz,Ed | 0,00 | kN |
| T,Ed | 0,00 | kNm |
| My,Ed | 0,00 | kNm |
| Mz,Ed | 0,00 | kNm |

**Compression check**
According to EN 1993-1-1 article 6.2.4 and formula (6.9)

| | | |
|---|---|---|
| A | 1,6360e-03 | $m^2$ |
| Nc,Rd | 384,46 | kN |
| Unity check | 0,60 | - |

The member satisfies the section check.

**...::STABILITY CHECK::...**
**Classification for member buckling design**
Decisive position for stability classification: 0,000 m
**Classification of Internal Compression parts**
According to EN 1993-1-1 Table 5.2 Sheet 1

| | |
|---|---|
| Maximum width-to-thickness ratio | 15,00 |
| Class 1 Limit | 33,00 |
| Class 2 Limit | 38,00 |

| | |
|---|---|
| Class 3 Limit | 42,00 |

=> Section classified as Class 1 for member buckling design

**Flexural Buckling check**
According to EN 1993-1-1 article 6.3.1.1 and formula (6.46)

| Buckling parameters | yy | zz | |
|---|---|---|---|
| Sway type | sway | non-sway | |
| System length L | 2,557 | 2,557 | m |
| Buckling factor k | 1,00 | 1,00 | |
| Buckling length Lcr | 2,557 | 2,557 | m |
| Critical Euler load Ncr | 611,36 | 611,36 | kN |
| Slenderness Lambda | 74,47 | 74,47 | |
| Relative slenderness Lambda,rel | 0,79 | 0,79 | |
| Limit slenderness Lambda,rel,0 | 0,20 | 0,20 | |
| Buckling curve | c | c | |
| Imperfection Alpha | 0,49 | 0,49 | |
| Reduction factor Chi | 0,67 | 0,67 | |
| Buckling resistance Nb,Rd | 256,26 | 256,26 | kN |

| Flexural Buckling verification | | |
|---|---|---|
| Cross-section area A | 1,6360e-03 | $m^2$ |
| Buckling resistance Nb,Rd | 256,26 | kN |
| Unity check | 0,90 | - |

**Torsional(-Flexural) Buckling check**
According to EN 1993-1-1 article 6.3.1.1 and formula (6.46)
**Note:** The cross-section concerns a RHS section which is not susceptible to Torsional(-Flexural) Buckling.

The member satisfies the stability check.

## 16. Dimenzioniranje ispune rešetke pozicije R5

Linear calculation, Extreme : Global
Selection : All
Combinations : GSN1
Cross-section : Ispuna5 - CFRHS90X90X6

**EN 1993-1-1 Code Check**
National annex: Standard EN

| | | | | | |
|---|---|---|---|---|---|
| **Member B61** | **2,557 m** | **CFRHS90X90X6** | **S 235** | **GSN1/2** | **0,92 -** |

Note: EN 1993-1-3 article 1.1(3) specifies that this part does not apply to cold formed CHS and RHS sections.
The default EN 1993-1-1 code check is executed instead of the EN 1993-1-3 code check.

| Partial safety factors | |
|---|---|
| Gamma M0 for resistance of cross-sections | 1,00 |
| Gamma M1 for resistance to instability | 1,00 |
| Gamma M2 for resistance of net sections | 1,25 |

| Material | | |
|---|---|---|
| Yield strength fy | 235,0 | MPa |
| Ultimate strength fu | 360,0 | MPa |
| Fabrication | Cold formed | |

**...::SECTION CHECK::...**

**Classification for cross-section design**
According to EN 1993-1-1 article 5.5.2
**Classification of Internal Compression parts**
According to EN 1993-1-1 Table 5.2 Sheet 1

| | |
|---|---|
| Maximum width-to-thickness ratio | 12,00 |
| Class 1 Limit | 33,00 |
| Class 2 Limit | 38,00 |
| Class 3 Limit | 42,00 |

=> Section classified as Class 1 for cross-section design

**The critical check is on position 2.557 m**

| Internal forces | Calculated | Unit |
|---|---|---|
| N,Ed | -273,56 | kN |
| Vy,Ed | 0,00 | kN |
| Vz,Ed | 0,00 | kN |
| T,Ed | 0,00 | kNm |
| My,Ed | 0,00 | kNm |
| Mz,Ed | 0,00 | kNm |

**Compression check**
According to EN 1993-1-1 article 6.2.4 and formula (6.9)

| | | |
|---|---|---|
| A | 1,9230e-03 | $m^2$ |
| Nc,Rd | 451,90 | kN |

| | | |
|---|---|---|
| Unity check | 0,61 | - |

The member satisfies the section check.

**....::STABILITY CHECK::...**

**Classification for member buckling design**

Decisive position for stability classification: 0,000 m

**Classification of Internal Compression parts**

According to EN 1993-1-1 Table 5.2 Sheet 1

| | |
|---|---|
| Maximum width-to-thickness ratio | 12,00 |
| Class 1 Limit | 33,00 |
| Class 2 Limit | 38,00 |
| Class 3 Limit | 42,00 |

=> Section classified as Class 1 for member buckling design

**Flexural Buckling check**

According to EN 1993-1-1 article 6.3.1.1 and formula (6.46)

| Buckling parameters | yy | zz | |
|---|---|---|---|
| Sway type | sway | non-sway | |
| System length L | 2,557 | 2,557 | m |
| Buckling factor k | 1,00 | 1,00 | |
| Buckling length Lcr | 2,557 | 2,557 | m |
| Critical Euler load Ncr | 698,67 | 698,67 | kN |
| Slenderness Lambda | 75,53 | 75,53 | |
| Relative slenderness Lambda,rel | 0,80 | 0,80 | |
| Limit slenderness Lambda,rel,0 | 0,20 | 0,20 | |
| Buckling curve | c | c | |
| Imperfection Alpha | 0,49 | 0,49 | |
| Reduction factor Chi | 0,66 | 0,66 | |
| Buckling resistance Nb,Rd | 298,03 | 298,03 | kN |

| Flexural Buckling verification | | |
|---|---|---|
| Cross-section area A | 1,9230e-03 | $m^2$ |
| Buckling resistance Nb,Rd | 298,03 | kN |
| Unity check | 0,92 | - |

**Torsional(-Flexural) Buckling check**

According to EN 1993-1-1 article 6.3.1.1 and formula (6.46)

**Note:** The cross-section concerns a RHS section which is not susceptible to Torsional(-Flexural) Buckling.

The member satisfies the stability check.

# 17. Dimenzioniranje uzdužnog nosača pozicije UN

Linear calculation, Extreme : Global

Selection : All

Combinations : GSN1

Cross-section : Uzd_greda - HEA700

**EN 1993-1-1 Code Check**

National annex: Standard EN

| | | | | | |
|---|---|---|---|---|---|
| **Member B1012** | **77,400 m** | **HEA700** | **S 235** | **GSN1/2** | **0,74 -** |

| Partial safety factors | |
|---|---|
| Gamma M0 for resistance of cross-sections | 1,00 |
| Gamma M1 for resistance to instability | 1,00 |
| Gamma M2 for resistance of net sections | 1,25 |

| Material | | |
|---|---|---|
| Yield strength fy | 235,0 | MPa |
| Ultimate strength fu | 360,0 | MPa |
| Fabrication | Rolled | |

**....::SECTION CHECK::...**

**Classification for cross-section design**

According to EN 1993-1-1 article 5.5.2

**Classification of Internal Compression parts**

According to EN 1993-1-1 Table 5.2 Sheet 1

| | |
|---|---|
| Maximum width-to-thickness ratio | 40,14 |
| Class 1 Limit | 65,95 |
| Class 2 Limit | 75,94 |
| Class 3 Limit | 114,67 |

=> Internal Compression parts Class 1

**Classification of Outstand Flanges**

According to EN 1993-1-1 Table 5.2 Sheet 2

| | |
|---|---|
| Maximum width-to-thickness ratio | 4,29 |
| Class 1 Limit | 9,00 |
| Class 2 Limit | 10,00 |

| | |
|---|---|
| Class 3 Limit | 13,80 |

=> Outstand Flanges Class 1
=> Section classified as Class 1 for cross-section design

**The critical check is on position 70.000 m**

| Internal forces | Calculated | Unit |
|---|---|---|
| N,Ed | -154,07 | kN |
| Vy,Ed | 2,50 | kN |
| Vz,Ed | 98,81 | kN |
| T,Ed | 0,22 | kNm |
| My,Ed | 1052,71 | kNm |
| Mz,Ed | 4,47 | kNm |

**Compression check**
According to EN 1993-1-1 article 6.2.4 and formula (6.9)

| | | |
|---|---|---|
| A | 2,6100e-02 | $m^2$ |
| Nc,Rd | 6133,50 | kN |
| Unity check | 0,03 | - |

**Bending moment check for My**
According to EN 1993-1-1 article 6.2.5 and formula (6.12),(6.13)

| | | |
|---|---|---|
| Wpl,y | 7,0417e-03 | $m^3$ |
| Mpl,y,Rd | 1654,79 | kNm |
| Unity check | 0,64 | - |

**Bending moment check for Mz**
According to EN 1993-1-1 article 6.2.5 and formula (6.12),(6.13)

| | | |
|---|---|---|
| Wpl,z | 1,2583e-03 | $m^3$ |
| Mpl,z,Rd | 295,71 | kNm |
| Unity check | 0,02 | - |

**Shear check for Vy**
According to EN 1993-1-1 article 6.2.6 and formula (6.17)

| | | |
|---|---|---|
| Eta | 1,20 | |
| Av | 1,6802e-02 | $m^2$ |
| Vpl,y,Rd | 2279,62 | kN |
| Unity check | 0,00 | - |

**Shear check for Vz**
According to EN 1993-1-1 article 6.2.6 and formula (6.17)

| | | |
|---|---|---|
| Eta | 1,20 | |
| Av | 1,1750e-02 | $m^2$ |
| Vpl,z,Rd | 1594,14 | kN |
| Unity check | 0,06 | - |

**Torsion check**
According to EN 1993-1-1 article 6.2.7 and formula (6.23)

| | | |
|---|---|---|
| Tau,t,Ed | 1,2 | MPa |
| Tau,Rd | 135,7 | MPa |
| Unity check | 0,01 | - |

**Note:** The unity check for torsion is lower than the limit value of 0,05. Therefore torsion is considered as insignificant and is ignored in the combined checks.

**Combined bending, axial force and shear force check**
According to EN 1993-1-1 article 6.2.9.1 and formula (6.41)

| | | |
|---|---|---|
| Mpl,y,Rd | 1654,79 | kNm |
| Alpha | 2,00 | |
| Mpl,z,Rd | 295,71 | kNm |
| Beta | 1,00 | |

Unity check (6.41) = 0,40 + 0,02 = 0,42 -

**Note:** Since the shear forces are less than half the plastic shear resistances their effect on the moment resistances is neglected.
**Note:** Since the axial force satisfies both criteria (6.33) and (6.34) of EN 1993-1-1 article 6.2.9.1(4) its effect on the moment resistance about the y-y axis is neglected.
**Note:** Since the axial force satisfies criteria (6.35) of EN 1993-1-1 article 6.2.9.1(4) its effect on the moment resistance about the z-z axis is neglected.

The member satisfies the section check.

**...::STABILITY CHECK::...**
**Classification for member buckling design**
Decisive position for stability classification: 65,000 m
**Classification of Internal Compression parts**
According to EN 1993-1-1 Table 5.2 Sheet 1

| | |
|---|---|
| Maximum width-to-thickness ratio | 40,14 |

| | |
|---|---|
| Class 1 Limit | 65,95 |
| Class 2 Limit | 75,94 |
| Class 3 Limit | 108,14 |

=> Internal Compression parts Class 1

**Classification of Outstand Flanges**

According to EN 1993-1-1 Table 5.2 Sheet 2

| | |
|---|---|
| Maximum width-to-thickness ratio | 4,29 |
| Class 1 Limit | 9,00 |
| Class 2 Limit | 10,00 |
| Class 3 Limit | 13,81 |

=> Outstand Flanges Class 1

=> Section classified as Class 1 for member buckling design

**Flexural Buckling check**

According to EN 1993-1-1 article 6.3.1.1 and formula (6.46)

| Buckling parameters | yy | zz | |
|---|---|---|---|
| Sway type | sway | non-sway | |
| System length L | 5,000 | 5,000 | m |
| Buckling factor k | 2,00 | 2,00 | |
| Buckling length Lcr | 10,000 | 10,000 | m |
| Critical Euler load Ncr | 44561,26 | 2528,59 | kN |
| Slenderness Lambda | 34,84 | 146,26 | |
| Relative slenderness Lambda,rel | 0,37 | 1,56 | |
| Limit slenderness Lambda,rel,0 | 0,20 | 0,20 | |
| Buckling curve | a | b | |
| Imperfection Alpha | 0,21 | 0,34 | |
| Reduction factor Chi | 0,96 | 0,32 | |
| Buckling resistance Nb,Rd | 5889,78 | 1974,53 | kN |

| Flexural Buckling verification | | |
|---|---|---|
| Cross-section area A | 2,6100e-02 | $m^2$ |
| Buckling resistance Nb,Rd | 1974,53 | kN |
| Unity check | 0,08 | - |

**Torsional(-Flexural) Buckling check**

According to EN 1993-1-1 article 6.3.1.1 and formula (6.46)

**Note:** For this I-section the Torsional(-Flexural) buckling resistance is higher than the resistance for Flexural buckling. Therefore Torsional(-Flexural) buckling is not printed on the output.

**Lateral Torsional Buckling check**

According to EN 1993-1-1 article 6.3.2.1 & 6.3.2.3 and formula (6.54)

| LTB parameters | | |
|---|---|---|
| Method for LTB curve | Alternative case | |
| Cross-section plastic modulus Wpl,y | 7,0417e-03 | $m^3$ |
| Elastic critical moment Mcr | 5091,13 | kNm |
| Relative slenderness Lambda,rel,LT | 0,57 | |
| Limit slenderness Lambda,rel,LT,0 | 0,40 | |
| LTB curve | c | |
| Imperfection Alpha,LT | 0,49 | |
| LTB factor Beta | 0,75 | |
| Reduction factor Chi,LT | 0,90 | |
| Correction factor kc | 0,88 | |
| Correction factor f | 0,95 | |
| Modified reduction factor Chi,LT,mod | 0,96 | |
| Design buckling resistance Mb,Rd | 1581,33 | kNm |
| Unity check | 0,67 | - |

| Mcr parameters | | |
|---|---|---|
| LTB length L | 5,000 | m |
| Influence of load position | no influence | |
| Correction factor k | 1,00 | |
| Correction factor kw | 1,00 | |
| LTB moment factor C1 | 1,30 | |
| LTB moment factor C2 | 0,00 | |
| LTB moment factor C3 | 1,00 | |
| Shear center distance d,z | 0 | mm |
| Distance of load application z,g | 0 | mm |
| Mono-symmetry constant beta,y | 0 | mm |
| Mono-symmetry constant z,j | 0 | mm |

**Note:** C parameters are determined according to ECCS 119 2006 / Galea 2002.

**Note:** The correction factor kc is determined from C1.

**Bending and axial compression check**

According to EN 1993-1-1 article 6.3.3 and formula (6.61),(6.62)

| Bending and axial compression check parameters | | |
|---|---|---|
| Interaction method | alternative method 1 | |
| Cross-section area A | 2,6100e-02 | $m^2$ |
| Cross-section plastic modulus Wpl,y | 7,0417e-03 | $m^3$ |
| Cross-section plastic modulus Wpl,z | 1,2583e-03 | $m^3$ |
| Design compression force N,Ed | 154,07 | kN |
| Design bending moment (maximum) My,Ed | 1052,71 | kNm |
| Design bending moment (maximum) Mz,Ed | 4,47 | kNm |
| Characteristic compression resistance N,Rk | 6133,50 | kN |
| Characteristic moment resistance My,Rk | 1654,79 | kNm |
| Characteristic moment resistance Mz,Rk | 295,71 | kNm |
| Reduction factor Chi,y | 0,96 | |
| Reduction factor Chi,z | 0,32 | |
| Modified reduction factor Chi,LT,mod | 0,96 | |
| Interaction factor k,yy | 1,05 | |
| Interaction factor k,yz | 0,82 | |
| Interaction factor k,zy | 0,55 | |
| Interaction factor k,zz | 0,99 | |

Maximum moment My,Ed is derived from beam B1012 position 70,000 m.
Maximum moment Mz,Ed is derived from beam B1012 position 70,000 m.

| Interaction method 1 parameters | | |
|---|---|---|
| Critical Euler load N,cr,y | 44561,26 | kN |
| Critical Euler load N,cr,z | 2528,59 | kN |
| Elastic critical load N,cr,T | 17485,27 | kN |
| Cross-section plastic modulus Wpl,y | 7,0417e-03 | $m^3$ |
| Cross-section elastic modulus Wel,y | 6,2400e-03 | $m^3$ |
| Cross-section plastic modulus Wpl,z | 1,2583e-03 | $m^3$ |
| Cross-section elastic modulus Wel,z | 8,1200e-04 | $m^3$ |
| Second moment of area Iy | 2,1500e-03 | $m^4$ |
| Second moment of area Iz | 1,2200e-04 | $m^4$ |
| Torsional constant It | 5,1400e-06 | $m^4$ |
| Method for equivalent moment factor C,my,0 | Table A.2 Line 2 (General) | |
| Design bending moment (maximum) My,Ed | 1052,71 | kNm |
| Maximum relative deflection delta,z | -5,5 | mm |
| Equivalent moment factor C,my,0 | 1,00 | |
| Method for equivalent moment factor C,mz,0 | Table A.2 Line 2 (General) | |
| Design bending moment (maximum) Mz,Ed | 4,47 | kNm |
| Maximum relative deflection delta,y | 0,0 | mm |
| Equivalent moment factor C,mz,0 | 0,95 | |
| Factor mu,y | 1,00 | |
| Factor mu,z | 0,96 | |
| Factor epsilon,y | 28,58 | |
| Factor a,LT | 1,00 | |
| Critical moment for uniform bending Mcr,0 | 3923,64 | kNm |
| Relative slenderness Lambda,rel,0 | 0,65 | |
| Limit relative slenderness Lambda,rel,0,lim | 0,22 | |
| Equivalent moment factor C,my | 1,00 | |
| Equivalent moment factor C,mz | 0,95 | |
| Equivalent moment factor C,mLT | 1,03 | |
| Factor b,LT | 0,00 | |
| Factor c,LT | 0,26 | |
| Factor d,LT | 0,00 | |
| Factor e,LT | 0,12 | |
| Factor w,y | 1,13 | |
| Factor w,z | 1,50 | |
| Factor n,pl | 0,03 | |
| Maximum relative slenderness Lambda,rel,max | 1,56 | |
| Factor C,yy | 0,99 | |
| Factor C,yz | 0,85 | |
| Factor C,zy | 0,95 | |
| Factor C,zz | 0,98 | |

Unity check (6.61) = 0,03 + 0,70 + 0,01 = 0,74 -
Unity check (6.62) = 0,08 + 0,36 + 0,01 = 0,46 -

**Shear Buckling check**
According to EN 1993-1-5 article 5 & 7.1 and formula (5.10) & (7.1)

| Shear Buckling parameters | | |
|---|---|---|
| Buckling field length a | 77,400 | m |
| Web | unstiffened | |
| Web height hw | 636 | mm |
| Web thickness t | 15 | mm |
| Material coefficient epsilon | 1,00 | |
| Shear correction factor Eta | 1,20 | |

| Shear Buckling verification | |
|---|---|
| Web slenderness hw/t | 43,86 |
| Web slenderness limit | 60,00 |

**Note:** The web slenderness is such that Shear Buckling effects may be ignored according to EN 1993-1-5 article 5.1(2).

The member satisfies the stability check.



# 18. Dimenzioniranje poprečnog nosača pozicije PN

Linear calculation, Extreme : Global
Selection : All
Combinations : GSN2
Cross-section : Pop_greda - HEA300

**EN 1993-1-1 Code Check**
National annex: Standard EN

| Member B1011 | 19,200 m | HEA300 | S 235 | GSN2/1 | 0,39 - |
|---|---|---|---|---|---|

| Partial safety factors | |
|---|---|
| Gamma M0 for resistance of cross-sections | 1,00 |
| Gamma M1 for resistance to instability | 1,00 |
| Gamma M2 for resistance of net sections | 1,25 |

| Material | | |
|---|---|---|
| Yield strength fy | 235,0 | MPa |
| Ultimate strength fu | 360,0 | MPa |
| Fabrication | Rolled | |

**...::SECTION CHECK::...**

**Classification for cross-section design**
According to EN 1993-1-1 article 5.5.2
**Classification of Internal Compression parts**
According to EN 1993-1-1 Table 5.2 Sheet 1

| | |
|---|---|
| Maximum width-to-thickness ratio | 24,47 |
| Class 1 Limit | 74,86 |
| Class 2 Limit | 86,29 |
| Class 3 Limit | 133,93 |

=> Internal Compression parts Class 1
**Classification of Outstand Flanges**
According to EN 1993-1-1 Table 5.2 Sheet 2



| | |
|---|---|
| Maximum width-to-thickness ratio | 8,48 |
| Class 1 Limit | 9,00 |
| Class 2 Limit | 10,00 |
| Class 3 Limit | 13,77 |

=> Outstand Flanges Class 1
=> Section classified as Class 1 for cross-section design

**The critical check is on position 2.557 m**

| Internal forces | Calculated | Unit |
|---|---|---|
| N,Ed | 30,96 | kN |
| Vy,Ed | -0,01 | kN |
| Vz,Ed | -52,70 | kN |
| T,Ed | 0,00 | kNm |
| My,Ed | -126,39 | kNm |
| Mz,Ed | 0,06 | kNm |

**Tension check**
According to EN 1993-1-1 article 6.2.3 and formula (6.5)

| | | |
|---|---|---|
| A | 1,1300e-02 | $m^2$ |
| Npl,Rd | 2655,50 | kN |
| Nu,Rd | 2928,96 | kN |
| Nt,Rd | 2655,50 | kN |
| Unity check | 0,01 | - |

**Bending moment check for My**
According to EN 1993-1-1 article 6.2.5 and formula (6.12),(6.13)

| | | |
|---|---|---|
| Wpl,y | 1,3833e-03 | $m^3$ |
| Mpl,y,Rd | 325,08 | kNm |
| Unity check | 0,39 | - |

**Bending moment check for Mz**
According to EN 1993-1-1 article 6.2.5 and formula (6.12),(6.13)

| | | |
|---|---|---|
| Wpl,z | 6,4167e-04 | $m^3$ |
| Mpl,z,Rd | 150,79 | kNm |
| Unity check | 0,00 | - |

**Shear check for Vy**
According to EN 1993-1-1 article 6.2.6 and formula (6.17)

| | | |
|---|---|---|
| Eta | 1,20 | |
| Av | 8,7017e-03 | $m^2$ |
| Vpl,y,Rd | 1180,63 | kN |
| Unity check | 0,00 | - |

**Shear check for Vz**
According to EN 1993-1-1 article 6.2.6 and formula (6.17)

| | | |
|---|---|---|
| Eta | 1,20 | |
| Av | 3,7750e-03 | $m^2$ |
| Vpl,z,Rd | 512,18 | kN |
| Unity check | 0,10 | - |

**Combined bending, axial force and shear force check**
According to EN 1993-1-1 article 6.2.9.1 and formula (6.41)

| | | |
|---|---|---|
| Mpl,y,Rd | 325,08 | kNm |
| Alpha | 2,00 | |
| Mpl,z,Rd | 150,79 | kNm |
| Beta | 1,00 | |

Unity check (6.41) = 0,15 + 0,00 = 0,15 -

**Note:** Since the shear forces are less than half the plastic shear resistances their effect on the moment resistances is neglected.
**Note:** Since the axial force satisfies both criteria (6.33) and (6.34) of EN 1993-1-1 article 6.2.9.1(4) its effect on the moment resistance about the y-y axis is neglected.
**Note:** Since the axial force satisfies criteria (6.35) of EN 1993-1-1 article 6.2.9.1(4) its effect on the moment resistance about the z-z axis is neglected.

The member satisfies the section check.

**...::STABILITY CHECK::...**
**Classification for member buckling design**
Decisive position for stability classification: 0,639 m
**Classification of Internal Compression parts**
According to EN 1993-1-1 Table 5.2 Sheet 1

| | |
|---|---|
| Maximum width-to-thickness ratio | 24,47 |
| Class 1 Limit | 87,30 |
| Class 2 Limit | 100,64 |
| Class 3 Limit | 179,49 |

=> Internal Compression parts Class 1
**Classification of Outstand Flanges**
According to EN 1993-1-1 Table 5.2 Sheet 2

| | |
|---|---|
| Maximum width-to-thickness ratio | 8,48 |
| Class 1 Limit | 9,00 |
| Class 2 Limit | 10,00 |
| Class 3 Limit | 13,78 |

=> Outstand Flanges Class 1
=> Section classified as Class 1 for member buckling design

**Lateral Torsional Buckling check**
According to EN 1993-1-1 article 6.3.2.1 & 6.3.2.3 and formula (6.54)

| LTB parameters | | |
|---|---|---|
| Method for LTB curve | Alternative case | |
| Cross-section plastic modulus Wpl,y | 1,3833e-03 | $m^3$ |
| Elastic critical moment Mcr | 5482,81 | kNm |
| Relative slenderness Lambda,rel,LT | 0,24 | |
| Limit slenderness Lambda,rel,LT,0 | 0,40 | |

**Note:** The slenderness or bending moment is such that Lateral Torsional Buckling effects may be ignored according to EN 1993-1-1 article 6.3.2.2(4).

| Mcr parameters | | |
|---|---|---|
| LTB length L | 2,557 | m |
| Influence of load position | no influence | |
| Correction factor k | 1,00 | |
| Correction factor kw | 1,00 | |
| LTB moment factor C1 | 1,83 | |
| LTB moment factor C2 | 0,01 | |
| LTB moment factor C3 | 1,00 | |
| Shear center distance d,z | 0 | mm |
| Distance of load application z,g | 0 | mm |
| Mono-symmetry constant beta,y | 0 | mm |
| Mono-symmetry constant z,j | 0 | mm |

**Note:** C parameters are determined according to ECCS 119 2006 / Galea 2002.

**Bending and axial tension check**
According to EN 1993-1-1-3 article 6.3

| | | |
|---|---|---|
| Design tension force N,Ed | 30,96 | kN |
| Design bending moment My,Ed | -126,39 | kNm |
| Design bending moment Mz,Ed | 0,06 | kNm |
| Tension resistance Nt,Rd | 2655,50 | kN |
| Bending resistance Mb,y,Rd | 325,08 | kNm |
| Bending resistance Mc,z,Rd,com | 150,79 | kNm |

Unity check = 0,39 + 0,00 - 0,01 = 0,38 -

**Shear Buckling check**
According to EN 1993-1-5 article 5 & 7.1 and formula (5.10) & (7.1)

| Shear Buckling parameters | | |
|---|---|---|
| Buckling field length a | 19,200 | m |
| Web | unstiffened | |
| Web height hw | 262 | mm |
| Web thickness t | 9 | mm |
| Material coefficient epsilon | 1,00 | |
| Shear correction factor Eta | 1,20 | |

| Shear Buckling verification | |
|---|---|
| Web slenderness hw/t | 30,82 |
| Web slenderness limit | 60,00 |

**Note:** The web slenderness is such that Shear Buckling effects may be ignored according to EN 1993-1-5 article 5.1(2).

The member satisfies the stability check.

## 19. Dimenzioniranje stupa

Linear calculation, Extreme : Global
Selection : All
Combinations : GSN2
Cross-section : Stup - CFCHS273X8

**EN 1993-1-1 Code Check**
National annex: Standard EN

| | | | | | |
|---|---|---|---|---|---|
| **Member B1016** | **7,924 m** | **CFCHS273X8** | **S 235** | **GSN2/1** | **0,73 -** |

Note: EN 1993-1-3 article 1.1(3) specifies that this part does not apply to cold formed CHS and RHS sections.
The default EN 1993-1-1 code check is executed instead of the EN 1993-1-3 code check.

| Partial safety factors | |
|---|---|
| Gamma M0 for resistance of cross-sections | 1,00 |
| Gamma M1 for resistance to instability | 1,00 |
| Gamma M2 for resistance of net sections | 1,25 |

| Material | | |
|---|---|---|
| Yield strength fy | 235,0 | MPa |
| Ultimate strength fu | 360,0 | MPa |
| Fabrication | Cold formed | |

**...::SECTION CHECK::...**

**Classification for cross-section design**
According to EN 1993-1-1 article 5.5.2
**Classification for Tubular Sections**
According to EN 1993-1-1 Table 5.2 Sheet 3

| | |
|---|---|
| Maximum width-to-thickness ratio | 34,13 |
| Class 1 Limit | 50,00 |
| Class 2 Limit | 70,00 |
| Class 3 Limit | 90,00 |

=> Section classified as Class 1 for cross-section design

**The critical check is on position 0.000 m**

| Internal forces | Calculated | Unit |
|---|---|---|
| N,Ed | -649,56 | kN |
| Vy,Ed | 0,00 | kN |
| Vz,Ed | 0,00 | kN |
| T,Ed | 0,00 | kNm |
| My,Ed | 0,00 | kNm |
| Mz,Ed | 0,00 | kNm |

**Compression check**
According to EN 1993-1-1 article 6.2.4 and formula (6.9)

| | | |
|---|---|---|
| A | 6,6600e-03 | $m^2$ |
| Nc,Rd | 1565,10 | kN |
| Unity check | 0,42 | - |

The member satisfies the section check.

...::STABILITY CHECK::...

**Classification for member buckling design**

Decisive position for stability classification: 0,000 m

**Classification for Tubular Sections**

According to EN 1993-1-1 Table 5.2 Sheet 3

| | |
|---|---|
| Maximum width-to-thickness ratio | 34,13 |
| Class 1 Limit | 50,00 |
| Class 2 Limit | 70,00 |
| Class 3 Limit | 90,00 |

=> Section classified as Class 1 for member buckling design

**Flexural Buckling check**

According to EN 1993-1-1 article 6.3.1.1 and formula (6.46)

| Buckling parameters | yy | zz | |
|---|---|---|---|
| Sway type | sway | non-sway | |
| System length L | 7,924 | 7,924 | m |
| Buckling factor k | 1,06 | 1,06 | |
| Buckling length Lcr | 8,420 | 8,420 | m |
| Critical Euler load Ncr | 1710,54 | 1710,54 | kN |
| Slenderness Lambda | 89,83 | 89,83 | |
| Relative slenderness Lambda,rel | 0,96 | 0,96 | |
| Limit slenderness Lambda,rel,0 | 0,20 | 0,20 | |
| Buckling curve | c | c | |
| Imperfection Alpha | 0,49 | 0,49 | |
| Reduction factor Chi | 0,57 | 0,57 | |
| Buckling resistance Nb,Rd | 885,12 | 885,12 | kN |

| Flexural Buckling verification | | |
|---|---|---|
| Cross-section area A | 6,6600e-03 | $m^2$ |
| Buckling resistance Nb,Rd | 885,12 | kN |
| Unity check | 0,73 | - |

**Torsional(-Flexural) Buckling check**

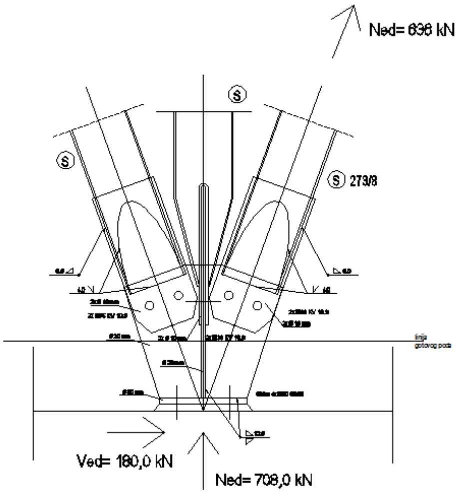
According to EN 1993-1-1 article 6.3.1.1 and formula (6.46)

**Note:** The cross-section concerns a CHS section which is not susceptible to Torsional(-Flexural) Buckling.

The member satisfies the stability check.

# 6. PRORAČUN SPOJEVA

## 6.1. SPOJ STUPOVA S TEMELJEM




*Slika 6.1:* Skica spoja stup - temelj

**Provjera nosivosti vertikalnih čvornih limova:**

debljina lima t= 20 mm

Nosivost na uzdužnu silu:

**Otpornost poprečnog presjeka**

Otpornost na djelovanje uzdužne sile

$$N_{c,Rd} = N_{pl,Rd} = \frac{A \cdot f_y}{\gamma_{M_0}} = \frac{2 \cdot 40 \cdot 23{,}5}{1{,}1} = 1709{,}0(kN)$$

Nosivost premašuje djelovanje, a izvijanje nije moguće zbog ukrućenja iz drugog smijera.

**Kontrola varova u spoju**

Duljina vara za uzdužnu silu

$l_{uzd}$= 2·60= 120 cm

Otpornost zavara u uvali za var a= 12 mm

$$F_{w,Rd} = \frac{f_u}{\sqrt{3} \cdot \beta_w \cdot \gamma_M} \cdot \mathrm{a} \cdot \mathrm{l} = \frac{36{,}0}{\sqrt{3} \cdot 0{,}8 \cdot 1{,}25} \cdot 1{,}2 \cdot 240 = 3000\,(k\mathrm{N})$$

Duljina vara za poprečnu silu

$l_{uzd}$= 2·40= 80 cm

Otpornost zavara u uvali za var a= 12 mm

$$F_{w,Rd} = \frac{f_u}{\sqrt{3} \cdot \beta_w \cdot \gamma_M} \cdot \mathrm{a} \cdot \mathrm{l} = \frac{36{,}0}{\sqrt{3} \cdot 0{,}8 \cdot 1{,}25} \cdot 0{,}8 \cdot 240 = 2000\,(k\mathrm{N})$$

**Kontrola nosivosti vijaka**

Vijci u stupu 2xM36 kv. 10.9.

Djelujuća sila – posimična sila $N_{Ed}$= 354 kN /po jednom vijku

- otpornost vijaka na posmik:

$$F_{v,Rd} = \frac{F_{v,Rk}}{\gamma_{M1}} = \frac{408.5}{1{,}25} = 364{,}4\,(kN) \ldots \text{ zadovoljava}$$

- pritisak po omotaču rupe čvornog lima:

$$F_{v,Rd} = \frac{F_{v,Rk}}{\gamma_{M1}} = \frac{324{,}0 \cdot 2}{1{,}25} = 518{,}4\,(kN) \text{ ... zadovoljava}$$

**Provjera nosivosti horizontalne pločice:**

**Kontrola nosivosti vijaka**

Vijci u pločici – sidra 4xM30 kv. S355

Djelujuća sila – vlačna sila $N_{Ed}$= 708 kN →177 kN / po jednom sidru

– posimična sila $N_{Ed}$= 180 kN →45 kN / po jednom sidru

- otpornost sidara na vlak:

$$F_{v,Rd} = \frac{F_{v,Rk}}{\gamma_{M1}} = \frac{0{,}9\dfrac{d^2\pi}{4}\cdot f_u}{\gamma_{M1}} = \frac{0{,}9\dfrac{3{,}0^2\cdot\pi}{4}\cdot 46{,}0}{1{,}25} = 234{,}1\,(kN) \text{ ... zadovoljava}$$

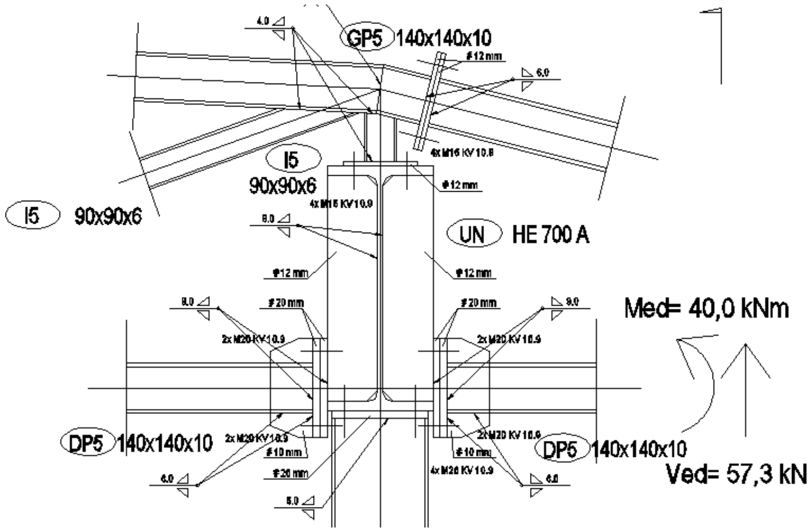
- otpornost sidra na posmik:

$$F_{v,Rd} = \frac{F_{v,Rk}}{\gamma_{M1}} = \frac{0{,}6\cdot 46\cdot 7{,}1}{1{,}25} = 156{,}0\,(kN) \text{ ... zadovoljava}$$

- pritisak po omotaču rupe pločice:

$$F_{v,Rd} = \frac{F_{v,Rk}}{\gamma_{M1}} = \frac{2{,}5\cdot\alpha\cdot f_u\cdot d\cdot t}{1{,}25} = \frac{2{,}5\cdot 1{,}0\cdot 46\cdot 3\cdot 3}{1{,}25} = 828{,}0\,(kN) \text{ ... zadovoljava}$$

## 6.2. OSLONAC REŠETKE NA UZDUŽNI NOSAČ UN




**Rezne sile:**

$M_{Ed,max}$=40 kNm

krak sile d= 21 cm

**Spreg sila od momenta:**

$F_{Ed}$= $M_{Ed}$/d= 4000/21

$F_{Ed}$= 190 kN

***Slika 6.2:*** Skica oslonca rešetke

**Kontrola nosivosti vijaka:**

Vijci u spoju 4xM20 kv. 10.9.

Djelujuća sila – uzdužna sila $N_{Ed}$= 95 kN /po jednom vijku

Djelujuća sila – posimična sila $V_{Ed}$= 15 kN /po jednom vijku

- otpornost sidara na vlak:

$$F_{v,Rd} = \frac{F_{v,Rk}}{\gamma_{M1}} = \frac{220,5}{1,25} = 176,4\,(kN) \text{... zadovoljava}$$

- otpornost vijaka na posmik:

$$F_{v,Rd} = \frac{F_{v,Rk}}{\gamma_{M1}} = \frac{122,5}{1,25} = 98(kN) \text{... zadovoljava}$$

- pritisak po omotaču rupe čvornog lima:

$$F_{v,Rd} = \frac{F_{v,Rk}}{\gamma_{M1}} = \frac{2,5 \cdot \alpha \cdot f_u \cdot d \cdot t}{1,25} = \frac{2,5 \cdot 0,53 \cdot 23,5 \cdot 2 \cdot 2}{1,25} = 99,64\,(kN) \text{... zadovoljava}$$

**Kontrola nosivosti pločice:**

Savijanje pločice uslijed vlačne sile u vijcima

$F_{Ed}$= 190 kN

Moment savijanja u pločici za krak d= 3,5 cm

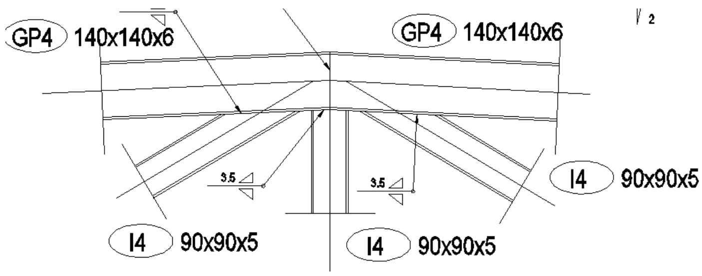
$M_{Ed}$= $F_{Ed}$·d= 190·3,5= 665 kNcm

$$M_{Ed} \leq \frac{W_{min} \cdot f_y}{1,1} \Rightarrow W_{min} = \frac{1.1 \cdot M_{Ed}}{f_y} = \frac{b_{pl} \cdot t^2{}_{pl}{}^{min}}{6}$$

$$t_{pl}{}^{min} = \sqrt{\frac{1,1 \cdot M_{Sd} \cdot 6}{b_{pl} \cdot f_y}} = \sqrt{\frac{1,1 \cdot 665 \cdot 6}{16 \cdot 23.5}} = 1.94\,(cm)$$

$$t_{pl} \geq 1,94\,(cm) \rightarrow t_{pl,odabrano} = 20(mm)$$

## 6.3. SPOJEVI POJASEVA I ISPUNA REŠETKI




***Slika 6.3:*** Skica priključka ispuna na pojas rešetke

Osnovni materijal: Čelik S235

**Geometrija poprečnih presjeka:**

$h_0 = 140\ mm \qquad b_0 = 140\ mm \qquad t_0 =$

$h_1 = 90\ mm \qquad b_1 = 90\ mm \qquad t_1 =$ varijabilno

$h_2 = 90\ mm \qquad b_2 = 90\ mm \qquad t_2 =$

Kontrola priključaka je obavljena tabelarno za cijelu krovnu rešetku jer je geometrija profila ista po segmentima, a rezne sile su uzete iz proračunskog modela. Popisani su priključci te su uneseni u novu tablicu s geometrijom i reznim silama. Nakon toga su provjereni uvjeti za primjenu EN 1993-1-8, tablica 7.8 i tablica 7.9. Pošto su svi uvjeti bili zadovoljeni, provjerena su dva moda otkazivanja, plastifikacija površine pojasa te otkazivanje ispune.

**Popis spojeva i njima pripadajućih reznih sila**

| popis spojeva | $N_{0,Ed}$(tlak) | $N_{0,Ed}$(vlak) | $N_{pl,Ed}$ | $N_{1,Ed}$(tlak) | $N_{2,Ed}$(vlak) |
|---|---|---|---|---|---|
| 90x5 - 140x5 | 309 | 314 | 314 | 216 | 222 |
| 90x5 - 140x6 | 267 | 349 | 349 | 230 | 236 |
| 90x6 - 140x10 | 763 | 800 | 800 | 330 | 380 |

***Tablica 6.1:*** Popis priključaka i mjerodavnih reznih sila

**Kriteriji za primjenu EN 1993-1-8, tablica 7.8 i 7.9. (uvjeti su dani u prvom redu tablice)**

| $b_0$ | $t_0$ | $b_i$ | $t_i$ | $b_i/t_i<35$ | $b_i/b_0>0{,}26$ | $0{,}5<h_0/b_0<2{,}0$ | $0{,}5<h_i/b_i<2{,}0$ | $b_0/t_0<35$ |
|---|---|---|---|---|---|---|---|---|
| 140 | 5,0 | 90 | 5,0 | 18,00 | 0,64 | 1,00 | 1,00 | 30,00 |
| 140 | 5,0 | 90 | 5,0 | 18,00 | 0,64 | 1,00 | 1,00 | 30,00 |
| 140 | 6,0 | 90 | 6,0 | 15,00 | 0,64 | 1,00 | 1,00 | 30,00 |

***Tablica 6.2:*** Kontrola uvjeta za primjenu norme

**Plastifikacija površine pojasa**

$$N_{i,Rd} = \left[ \frac{8.9 \cdot \gamma^{0.5} \cdot k_n \cdot f_y \cdot t_0^{\;2}}{(1-\beta) \cdot \sin\theta_i} \cdot \left( \frac{2 \cdot \beta}{\sin\theta_i} + 4 \cdot \sqrt{1-\beta} \right) / \gamma_{M5} \right] \cdot 0.9$$

$\gamma = \dfrac{b_0}{2t_0} \qquad \beta = \dfrac{b_i}{b_0} \qquad k_n = 1{,}3 - \dfrac{0.4n}{\beta} < 1.0 \quad n = \left( \dfrac{\sigma_{0,Ed}}{f_{y0}} \right) / \gamma_{M5} \qquad k_n = 1.0$ ..za vlak

| γ | θ | sinΘ | fy | β | A(cm2) | σ | n | kn | N1,Rd | usporedba |
|---|---|---|---|---|---|---|---|---|---|---|
| 14,00 | 0,884882 | 0,7738 | 23,5 | 0,533 | 33,5 | 9,37 | 0,40 | 1,00 | 309,633 | 0,70 |
| 14,00 | 0,884882 | 0,7738 | 23,5 | 0,533 | 33,5 | 10,42 | 0,44 | 0,97 | 299,574 | 0,77 |
| 11,67 | 1,471313 | 0,9951 | 23,5 | 0,467 | 43,5 | 17,54 | 0,75 | 0,79 | 386,21 | 0,98 |

***Tablica 6.3:*** Kontrola nosivosti za mod otkazivanja koji se odnosi na plastifikaciju površine pojasa

**4. Lom ispune**

$$N_{i,Rd} = \left[ f_{yi} \cdot t_i \cdot \left( b_{eff} + b_{e,ov} + \frac{\lambda_{ov}}{50} \cdot (2h_i - 4t_i) \right) / \gamma_{M5} \right] \cdot 0.9$$

$$b_{eff} = \frac{10}{b_0 / t_0} \frac{f_{y0} \cdot t_0}{f_{yi} \cdot t_i} b_i \le b_i \qquad b_{e,ov} = \frac{10}{b_j / t_j} \frac{f_{yj} \cdot t_j}{f_{yi} \cdot t_i} b_i \le b_i$$

| beff | be,ov | λov | N1,Rd | usporedba |
|---|---|---|---|---|
| 32,14 | 50 | 0,55 | 303,32 | 0,73 |
| 32,14 | 50 | 0,55 | 303,32 | 0,78 |
| 38,57 | 72 | 0,55 | 397,86 | 0,96 |

***Tablica 6.4:*** Kontrola nosivosti za mod otkazivanja koji se odnosi na lom ispune

**Debljine varova**

Varovi su proračunati da preuzimaju vlačne sile u priključku, ali su ograničeni tako da minimalna debljina bude 3 mm

| duljina vara | debljina vara | Fw,rk | Fw,Rd | usporedba |
|---|---|---|---|---|
| 320 | 3,5 | 2619 | 2095 | 0,23 |
| 320 | 3,5 | 2619 | 2095 | 0,23 |
| 320 | 4 | 2993 | 2394 | 0,14 |

***Tablica 6.5:*** Debljine varova u pojedinim priključcima

# 7. GRAĐEVINSKI NACRTI

## 7.1. GRAĐEVINSKI NACRTI ZA GLAVNI PROJEKT

| | | |
|---|---|---|
| **7.1.1.** | **Plan pozicija – Tlocrt i uzdužni presjek nadstrešnice** | **M 1:200** |
| **7.1.2.** | **Plan pozicija – Poprečni presjek nadstrešnice** | **M 1:100** |

## 7.2. GRAĐEVINSKI NACRTI ZA IZVEDBENI PROJEKT

| | | |
|---|---|---|
| **7.2.1.** | **Plan pozicija kompletne nadstrešnice** | **M 1:100** |
| **7.2.2.** | **Plan pozicija dilatacije C1** | **M 1:100** |
| **7.2.3.** | **Detalj spoja stupova i temelja** | **M 1:10** |
| **7.2.4.** | **Detalj oslanjanja poprečnog nosača pozicije PN na uzdužni nosač pozicije UN i detalj spoja stupa i poprečnog nosača** | **M 1:10** |
| **7.2.5.** | **Detalj oslanjanja rešetke na uzdužni nosač pozicije UN** | **M 1:10** |
| **7.2.6.** | **Detalj čvora rešetke u osi D** | **M 1:10** |
| **7.2.7.** | **Detalj čvora rešetke u osi A** | **M 1:10** |
| **7.2.8.** | **Detalj čvora rešetke u osi G** | **M 1:10** |
| **7.2.9.** | **Montažni nastavak uzdužnog nosača pozicije UN** | **M 1:10** |
| **7.2.10.** | **Montažni nastavak poprečnog nosača pozicije PN** | **M 1:10** |
| **7.2.11.** | **Stupovi pozicije S1, S2 i S3** | **M 1:10 1:20** |
| **7.2.12.** | **Uzdužni nosač pozicije UN1** | **M 1:10 1:20** |
| **7.2.13.** | **Poprečni nosač nosač pozicije PN1 i PN2** | **M 1:10 1:20** |
| **7.2.14.** | **Kljunovi rešetki** | **M 1:10 1:20** |
| **7.2.15.** | **Rešetka pozicije R1** | **M 1:10 1:20** |
| **7.2.16.** | **Rešetka pozicije R3** | **M 1:10 1:20** |
| **7.2.13.** | **Zatege** | **M 1:10 1:20** |
| **7.2.14.** | **Pločice** | **M 1:10 1:20** |

# 7.3. ISKAZ MATERIJALA

## 7.3.1. Iskaz materijala za cijelu nadstrešnicu

### Iskaz profila

| Section | Grade | Length (mm) | Mass | |
|---|---|---|---|---|
| | | | Unit (kg/m) | Total (kg) |
| CHS 273x8 | S 235 | 415398,90 | 52,300 | 21725,37 |
| HEA 300 | S 235 | 191400,00 | 88,334 | 16907,19 |
| HEA 700 | S 235 | 357520,04 | 204,475 | 73103,91 |
| L 110x110x10 | S 235 | 25040,00 | 16,600 | 415,66 |
| Q 140x140x10 | S 235 | 395626,49 | 38,851 | 15370,56 |
| Q 140x140x5 | S 235 | 625451,26 | 21,108 | 13202,10 |
| Q 140x140x6 | S 235 | 252235,79 | 24,983 | 6301,62 |
| Q 140x140x8 | S 235 | 681814,47 | 32,019 | 21831,08 |
| Q 90x90x4 | S 235 | 85988,82 | 10,707 | 920,68 |
| Q 90x90x5 | S 235 | 831225,31 | 13,052 | 10849,46 |
| Q 90x90x6 | S 235 | 229303,53 | 15,398 | 3530,75 |
| ROND 16 | S 235 | 629080,00 | 1,580 | 993,95 |

***Tablica 7.1***: Sumarni iskaz profila cijele nadstrešnice

### Iskaz pločica

| Position | Section | Length (mm) | Number | material | Mass | |
|---|---|---|---|---|---|---|
| | | | | | of element (kg) | Total (kg) |
| pl 1 | Plate 10x112 | 182,43 | 4 | S 235 | 0,94 | 3,78 |
| pl 2 | Plate 10x95 | 184,61 | 16 | S 235 | 0,92 | 14,71 |
| pl 3 | Plate 10x90 | 184,75 | 16 | S 235 | 0,88 | 14,14 |
| pl 4 | Plate 10x97 | 185,28 | 16 | S 235 | 0,93 | 14,81 |
| pl 5 | Plate 10x90 | 189,93 | 8 | S 235 | 0,93 | 7,48 |
| pl 6 | Plate 70x23 | 190,00 | 200 | S 235 | 1,08 | 215,21 |
| pl 7 | Plate 10x100 | 192,39 | 4 | S 235 | 0,97 | 3,87 |
| pl 8 | Plate 10x90 | 192,80 | 16 | S 235 | 0,90 | 14,35 |
| pl 9 | Plate 10x90 | 192,80 | 16 | S 235 | 0,90 | 14,35 |
| pl 10 | Plate 10x90 | 193,47 | 16 | S 235 | 0,90 | 14,44 |
| pl 11 | Plate 10x90 | 193,54 | 16 | S 235 | 0,91 | 14,52 |
| pl 12 | Plate 10x94 | 194,81 | 32 | S 235 | 0,88 | 28,19 |
| pl 13 | Plate 6x200 | 200,00 | 40 | S 235 | 1,81 | 72,58 |
| pl 14 | Plate 10x90 | 201,90 | 8 | S 235 | 0,94 | 7,55 |
| pl 15 | Plate 10x102 | 204,37 | 16 | S 235 | 0,91 | 14,50 |
| pl 16 | Plate 10x110 | 205,11 | 16 | S 235 | 0,88 | 14,05 |
| pl 17 | Plate 12x160 | 210,00 | 80 | S 235 | 3,07 | 245,82 |
| pl 18 | Plate 8x420 | 257,00 | 120 | S 235 | 5,17 | 620,45 |
| pl 19 | Plate 10x146 | 262,00 | 80 | S 235 | 2,93 | 234,24 |
| pl 20 | Plate 10x120 | 280,00 | 160 | S 235 | 2,23 | 356,83 |
| pl 21 | Plate 12x160 | 280,00 | 80 | S 235 | 4,13 | 330,26 |
| pl 22 | Plate 20x160 | 280,00 | 320 | S 235 | 6,80 | 2177,09 |
| pl 23 | Plate 8x300 | 340,00 | 40 | S 235 | 6,22 | 248,87 |
| pl 24 | Plate 8x115 | 340,00 | 80 | S 235 | 2,36 | 189,06 |
| pl 25 | Plate 8x143 | 400,00 | 20 | S 235 | 3,51 | 70,12 |
| pl 26 | Plate 30x390 | 440,00 | 20 | S 235 | 39,33 | 786,59 |
| pl 27 | Plate 20x300 | 500,00 | 60 | S 235 | 23,33 | 1399,55 |
| pl 28 | Plate 16x300 | 560,00 | 64 | S 235 | 20,33 | 1301,01 |
| pl 29 | Plate 16x115 | 560,00 | 128 | S 235 | 7,70 | 985,79 |
| pl 30 | Plate 10x240 | 560,00 | 64 | S 235 | 10,32 | 660,58 |
| pl 31 | Plate 20x356 | 609,47 | 20 | S 235 | 24,41 | 488,29 |
| pl 32 | Plate 20x150 | 609,47 | 20 | S 235 | 12,47 | 249,44 |
| pl 33 | Plate 12x143 | 636,00 | 248 | S 235 | 8,47 | 2100,71 |
| pl 34 | Plate 8x143 | 636,00 | 20 | S 235 | 5,64 | 112,74 |
| pl 35 | Plate 300x41 | 650,50 | 60 | S 235 | 29,86 | 1791,64 |
| pl 36 | Plate 20x693 | 666,84 | 20 | S 235 | 51,42 | 1028,42 |

***Tablica 7.2***: Sumarni iskaz pločica cijele nadstrešnice

## Iskaz po sklopovima

| Position | Element name | Number | Length [mm] | Mass | |
|---|---|---|---|---|---|
| | | | | of element [kg] | Total [kg] |
| 1 | Sub part - profile L 110x110x10 | 20 | 626,00 | 10,39 | 207,83 |
| 2 | Sub part - profile L 110x110x10 | 20 | 626,00 | 10,39 | 207,83 |
| D 1 | D ROND 16 | 100 | 2130,00 | 4,24 | 423,61 |
| D 2 | D ROND 16 | 8 | 3470,00 | 6,35 | 50,83 |
| D 3 | D ROND 16 | 8 | 3830,00 | 6,92 | 55,38 |
| D 4 | D ROND 16 | 24 | 4080,00 | 7,32 | 175,61 |
| D 5 | D ROND 16 | 24 | 4430,00 | 7,87 | 188,88 |
| D 6 | D ROND 16 | 8 | 4510,00 | 8,00 | 63,97 |
| D 7 | D ROND 16 | 4 | 4560,00 | 8,08 | 32,30 |
| D 8 | D ROND 16 | 12 | 5080,00 | 8,90 | 106,76 |
| D 9 | D ROND 16 | 8 | 5130,00 | 8,98 | 71,81 |
| D 10 | D ROND 16 | 4 | 5780,00 | 10,00 | 40,01 |
| KR 1 | KR Q 140x140x5 | 3 | 3370,97 | 151,01 | 453,03 |
| KR 2 | KR Q 140x140x5 | 10 | 3370,97 | 185,99 | 1859,90 |
| KR 3 | KR Q 140x140x5 | 4 | 3370,97 | 186,87 | 747,47 |
| KR 4 | KR Q 140x140x5 | 4 | 3370,97 | 186,87 | 747,47 |
| KR 5 | KR Q 140x140x5 | 1 | 3370,97 | 186,90 | 186,90 |
| KR 6 | KR Q 140x140x6 | 5 | 3370,97 | 198,87 | 994,36 |
| KR 7 | KR Q 140x140x6 | 3 | 3370,97 | 199,78 | 599,34 |
| KR 8 | KR Q 140x140x6 | 2 | 3370,97 | 199,78 | 399,56 |
| KR 9 | KR Q 140x140x10 | 2 | 3370,97 | 266,88 | 533,77 |
| KR 10 | KR Q 140x140x10 | 1 | 3370,97 | 267,79 | 267,79 |
| KR 11 | KR Q 140x140x10 | 1 | 3370,97 | 267,79 | 267,79 |
| KR 12 | KR Q 140x140x10 | 2 | 3370,97 | 267,83 | 535,65 |
| KR 13 | KR Q 140x140x10 | 2 | 3370,97 | 267,83 | 535,65 |
| PH 1 | PH HEA 300 | 20 | 6000,00 | 541,72 | 10834,36 |
| PH 2 | PH HEA 300 | 10 | 7140,00 | 630,71 | 6307,07 |
| PL 1 | Plate Plate 6x200 | 40 | 200,00 | 1,81 | 72,58 |
| PL 2 | Plate Plate 8x300 | 40 | 340,00 | 6,22 | 248,87 |
| PL 3 | Plate Plate 8x115 | 80 | 340,00 | 2,36 | 189,06 |
| PL 4 | Plate Plate 16x300 | 64 | 560,00 | 20,33 | 1301,01 |
| PL 5 | Plate Plate 16x115 | 128 | 560,00 | 7,70 | 985,79 |
| PL 6 | Plate Plate 10x240 | 64 | 560,00 | 10,32 | 660,58 |
| PL 7 | Plate Plate 20x693 | 20 | 701,54 | 127,64 | 2552,73 |
| R 1 | R Q 140x140x5 | 3 | 21053,54 | 1240,70 | 3722,10 |
| R 2 | R Q 140x140x8 | 10 | 21053,54 | 1529,47 | 15294,70 |
| R 3 | R Q 140x140x8 | 4 | 21053,54 | 1537,43 | 6149,73 |
| R 4 | R Q 140x140x8 | 4 | 21053,54 | 1537,43 | 6149,73 |
| R 5 | R Q 140x140x8 | 1 | 21053,54 | 1537,64 | 1537,64 |
| R 6 | R Q 140x140x8 | 5 | 21053,54 | 1614,33 | 8071,63 |
| R 7 | R Q 140x140x8 | 2 | 21053,54 | 1622,50 | 3245,00 |
| R 8 | R Q 140x140x8 | 3 | 21053,54 | 1622,50 | 4867,50 |
| R 9 | R Q 140x140x10 | 2 | 21053,54 | 2123,97 | 4247,95 |
| R 10 | R Q 140x140x10 | 1 | 21053,54 | 2132,15 | 2132,15 |
| R 11 | R Q 140x140x10 | 1 | 21053,54 | 2132,15 | 2132,15 |
| R 12 | R Q 140x140x10 | 2 | 21053,54 | 2132,38 | 4264,75 |
| R 13 | R Q 140x140x10 | 2 | 21053,54 | 2132,38 | 4264,75 |
| S 1 | S CHS 273x8 | 20 | 7181,18 | 425,62 | 8512,33 |
| S 2 | S CHS 273x8 | 20 | 7181,23 | 425,62 | 8512,33 |
| S 3 | S CHS 273x8 | 20 | 7184,07 | 425,62 | 8512,34 |
| UH 1 | UH HEA 700 | 2 | 3280,01 | 670,68 | 1341,36 |
| UH 2 | UH HEA 700 | 6 | 8000,00 | 1696,90 | 10181,38 |
| UH 3 | UH HEA 700 | 2 | 8000,00 | 1696,90 | 3393,79 |
| UH 4 | UH HEA 700 | 2 | 10000,00 | 2148,87 | 4297,74 |
| UH 5 | UH HEA 700 | 1 | 10000,00 | 2165,81 | 2165,81 |
| UH 6 | UH HEA 700 | 6 | 10000,00 | 2105,85 | 12635,08 |
| UH 7 | UH HEA 700 | 2 | 10000,00 | 2148,87 | 4297,74 |
| UH 8 | UH HEA 700 | 2 | 10000,00 | 2148,87 | 4297,74 |
| UH 9 | UH HEA 700 | 2 | 10000,00 | 2148,87 | 4297,74 |
| UH 10 | UH HEA 700 | 1 | 10000,00 | 2148,87 | 2148,87 |
| UH 11 | UH HEA 700 | 1 | 10000,00 | 2148,87 | 2148,87 |
| UH 12 | UH HEA 700 | 1 | 10000,00 | 2165,81 | 2165,81 |
| UH 13 | UH HEA 700 | 1 | 11000,00 | 2383,89 | 2383,89 |
| UH 14 | UH HEA 700 | 1 | 11000,00 | 2383,89 | 2383,89 |
| UH 15 | UH HEA 700 | 1 | 12480,01 | 2686,52 | 2686,52 |
| UH 16 | UH HEA 700 | 1 | 12480,01 | 2686,52 | 2686,52 |
| UH 17 | UH HEA 700 | 1 | 15000,00 | 3232,34 | 3232,34 |
| UH 18 | UH HEA 700 | 1 | 15000,00 | 3232,34 | 3232,34 |
| UH 19 | UH HEA 700 | 1 | 15000,00 | 3249,28 | 3249,28 |
| UH 20 | UH HEA 700 | 1 | 15000,00 | 3249,28 | 3249,28 |
| Total mass [kg] | | | | | 200998,36 |
| Element mass [kg] | | | | 74951,54 | |
| Weld mass addition [kg] | | | | | 4019,97 |
| Total mass [kg] | | | | | 205018,33 |

***Tablica 7.3***: Sumarni iskaz materijala po sklopovima cijele nadstrešnice

## Utrošak materijala po m$^2$ nadstrešnice:

g= 205018 / (179,0x24,2)= 47,3 kg/m$^2$

### 7.3.1. Iskaz materijala dilatacije C1

## Iskaz profila

| Section | Grade | Length (mm) | Mass | |
|---|---|---|---|---|
| | | | Unit (kg/m) | Total (kg) |
| CHS 273x8 | S 235 | 166159,78 | 52,300 | 8690,15 |
| HEA 300 | S 235 | 76560,00 | 88,334 | 6762,87 |
| HEA 700 | S 235 | 154960,02 | 204,475 | 31685,45 |
| L 110x110x10 | S 235 | 10016,00 | 16,600 | 166,27 |
| Q 140x140x10 | S 235 | 197381,91 | 38,851 | 7668,52 |
| Q 140x140x5 | S 235 | 99181,58 | 21,108 | 2093,54 |
| Q 140x140x6 | S 235 | 252235,79 | 24,983 | 6301,62 |
| Q 140x140x8 | S 235 | 282130,13 | 32,019 | 9033,55 |
| Q 90x90x4 | S 235 | 28662,94 | 10,707 | 306,89 |
| Q 90x90x5 | S 235 | 343955,30 | 13,052 | 4489,43 |
| Q 90x90x6 | S 235 | 114651,77 | 15,398 | 1765,38 |
| ROND 16 | S 235 | 252800,00 | 1,580 | 399,42 |

***Tablica 7.4***: Sumarni iskaz profila dilatacije C1

## Iskaz pločica

| Position | Section | Length (mm) | Number | Mass | |
|---|---|---|---|---|---|
| | | | | of element (kg) | Total (kg) |
| pl 1 | Plate 10x97 | 185,28 | 16 | 0,93 | 14,81 |
| pl 2 | Plate 70x23 | 190,00 | 80 | 1,08 | 86,09 |
| pl 3 | Plate 10x90 | 192,80 | 16 | 0,90 | 14,35 |
| pl 4 | Plate 10x90 | 193,47 | 16 | 0,90 | 14,44 |
| pl 5 | Plate 10x90 | 193,54 | 16 | 0,91 | 14,52 |
| pl 6 | Plate 6x200 | 200,00 | 16 | 1,81 | 29,03 |
| pl 7 | Plate 10x102 | 204,37 | 16 | 0,91 | 14,50 |
| pl 8 | Plate 12x160 | 210,00 | 34 | 3,07 | 104,47 |
| pl 9 | Plate 8x420 | 257,00 | 48 | 5,17 | 248,18 |
| pl 10 | Plate 10x146 | 262,00 | 32 | 2,93 | 93,70 |
| pl 11 | Plate 10x120 | 280,00 | 68 | 2,23 | 151,65 |
| pl 12 | Plate 12x160 | 280,00 | 34 | 4,13 | 140,36 |
| pl 13 | Plate 20x160 | 280,00 | 136 | 6,80 | 925,27 |
| pl 14 | Plate 8x300 | 340,00 | 16 | 6,22 | 99,55 |
| pl 15 | Plate 8x115 | 340,00 | 32 | 2,36 | 75,62 |
| pl 16 | Plate 8x143 | 400,00 | 8 | 3,51 | 28,05 |
| pl 17 | Plate 30x390 | 440,00 | 8 | 39,33 | 314,64 |
| pl 18 | Plate 20x300 | 500,00 | 24 | 23,33 | 559,82 |
| pl 19 | Plate 16x300 | 560,00 | 24 | 20,33 | 487,88 |
| pl 20 | Plate 16x115 | 560,00 | 48 | 7,70 | 369,67 |
| pl 21 | Plate 10x240 | 560,00 | 24 | 10,32 | 247,72 |
| pl 22 | Plate 20x356 | 609,47 | 8 | 24,41 | 195,31 |
| pl 23 | Plate 20x150 | 609,47 | 8 | 12,47 | 99,77 |
| pl 24 | Plate 12x143 | 636,00 | 100 | 8,47 | 847,06 |
| pl 25 | Plate 8x143 | 636,00 | 8 | 5,64 | 45,10 |
| pl 26 | Plate 300x41 | 650,50 | 24 | 29,86 | 716,66 |
| pl 27 | Plate 20x693 | 666,84 | 8 | 51,42 | 411,37 |

***Tablica 7.5***: Sumarni iskaz pločica dilatacije C1

## Iskaz po sklopovima

| Position | Element name | Number | Length (mm) | Mass | |
|---|---|---|---|---|---|
| | | | | of element (kg) | Total (kg) |
| 1 | Sub part - profile L 110x110x10 | 8 | 626,00 | 10,39 | 83,13 |
| 2 | Sub part - profile L 110x110x10 | 8 | 626,00 | 10,39 | 83,13 |
| D 1 | D ROND 16 | 40 | 2130,00 | 4,24 | 169,44 |
| D 2 | D ROND 16 | 8 | 3830,00 | 6,92 | 55,38 |
| D 3 | D ROND 16 | 24 | 4430,00 | 7,87 | 188,88 |
| D 4 | D ROND 16 | 8 | 5130,00 | 8,98 | 71,81 |
| KR 1 | KR Q 140x140x5 | 1 | 3370,97 | 151,01 | 151,01 |
| KR 2 | KR Q 140x140x5 | 1 | 3370,97 | 185,99 | 185,99 |
| KR 3 | KR Q 140x140x5 | 1 | 3370,97 | 186,90 | 186,90 |
| KR 4 | KR Q 140x140x6 | 5 | 3370,97 | 198,87 | 994,36 |
| KR 5 | KR Q 140x140x6 | 3 | 3370,97 | 199,78 | 599,34 |
| KR 6 | KR Q 140x140x6 | 2 | 3370,97 | 199,78 | 399,56 |
| KR 7 | KR Q 140x140x10 | 2 | 3370,97 | 266,88 | 533,77 |
| KR 8 | KR Q 140x140x10 | 1 | 3370,97 | 267,79 | 267,79 |
| KR 9 | KR Q 140x140x10 | 1 | 3370,97 | 267,79 | 267,79 |
| PN 1 | PN HEA 300 | 8 | 6000,00 | 541,72 | 4333,74 |
| PN 2 | PN HEA 300 | 4 | 7140,00 | 630,71 | 2522,83 |
| Pl 1 | Plate Plate 6x200 | 16 | 200,00 | 1,81 | 29,03 |
| Pl 2 | Plate Plate 8x300 | 16 | 340,00 | 6,22 | 99,55 |
| Pl 3 | Plate Plate 8x115 | 32 | 340,00 | 2,36 | 75,62 |
| Pl 4 | Plate Plate 16x300 | 24 | 560,00 | 20,33 | 487,88 |
| Pl 5 | Plate Plate 16x115 | 48 | 560,00 | 7,70 | 369,67 |
| Pl 6 | Plate Plate 10x240 | 24 | 560,00 | 10,32 | 247,72 |
| Pl 7 | Plate Plate 20x693 | 8 | 701,54 | 127,64 | 1021,09 |
| R 1 | R Q 140x140x5 | 1 | 21053,54 | 1240,70 | 1240,70 |
| R 2 | R Q 140x140x8 | 1 | 21053,54 | 1529,47 | 1529,47 |
| R 3 | R Q 140x140x8 | 1 | 21053,54 | 1537,64 | 1537,64 |
| R 4 | R Q 140x140x8 | 5 | 21053,54 | 1614,33 | 8071,63 |
| R 5 | R Q 140x140x8 | 2 | 21053,54 | 1622,50 | 3245,00 |
| R 6 | R Q 140x140x8 | 3 | 21053,54 | 1622,50 | 4867,50 |
| R 7 | R Q 140x140x10 | 2 | 21053,54 | 2123,97 | 4247,95 |
| R 8 | R Q 140x140x10 | 1 | 21053,54 | 2132,15 | 2132,15 |
| R 9 | R Q 140x140x10 | 1 | 21053,54 | 2132,15 | 2132,15 |
| S 1 | S CHS 273x8 | 8 | 7181,18 | 425,62 | 3404,93 |
| S 2 | S CHS 273x8 | 8 | 7181,23 | 425,62 | 3404,93 |
| S 3 | S CHS 273x8 | 8 | 7184,07 | 425,62 | 3404,94 |
| UN 1 | UN HEA 700 | 2 | 10000,00 | 2148,87 | 4297,74 |
| UN 2 | UN HEA 700 | 6 | 10000,00 | 2105,85 | 12635,08 |
| UN 3 | UN HEA 700 | 2 | 10000,00 | 2148,87 | 4297,74 |
| UN 4 | UN HEA 700 | 1 | 12480,01 | 2686,52 | 2686,52 |
| UN 5 | UN HEA 700 | 1 | 15000,00 | 3232,34 | 3232,34 |
| UN 6 | UN HEA 700 | 1 | 12480,01 | 2686,52 | 2686,52 |
| UN 7 | UN HEA 700 | 1 | 15000,00 | 3232,34 | 3232,34 |
| Total mass: (kg) | | | | | 85712,68 |
| Element mass: (kg) | | | | 38395,95 | |
| Weld mass addition (kg) | | | | | 1714,25 |
| Total mass (kg) | | | | | 87426,93 |

***Tablica 7.6***: Sumarni iskaz materijala po sklopovima dilatacije C1

## Utrošak materijala po $m^2$ dilatacije C1:

g= 87426,93 / (77,3x24,2)= 46,7 kg/$m^2$

# 8. LITERATURA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SADRŽAJ LISTA:

# PLAN POZICIJA - TLOCRT I UZDUŽNI PRESJEK NADSTREŠNICE

M 1:200


FAKULTET GRAĐEVINARSTVA, ARHITEKTURE I GEODEZIJE
KATEDRA ZA METALNE I DRVENE KONSTRUKCIJE
21000 SPLIT, MATICE HRVATSKE 15


GRAĐEVINA:
**Pristanišna zgrada zračne luke Dubrovnik Zgrada "ABC" - Sortirnica / Putnički terminal**

PROJEKT:
**Građenje južne nadstrešnice ispred zgrade "B" i zgrade "C"**


STUDENT:
**Mario Šarčević**

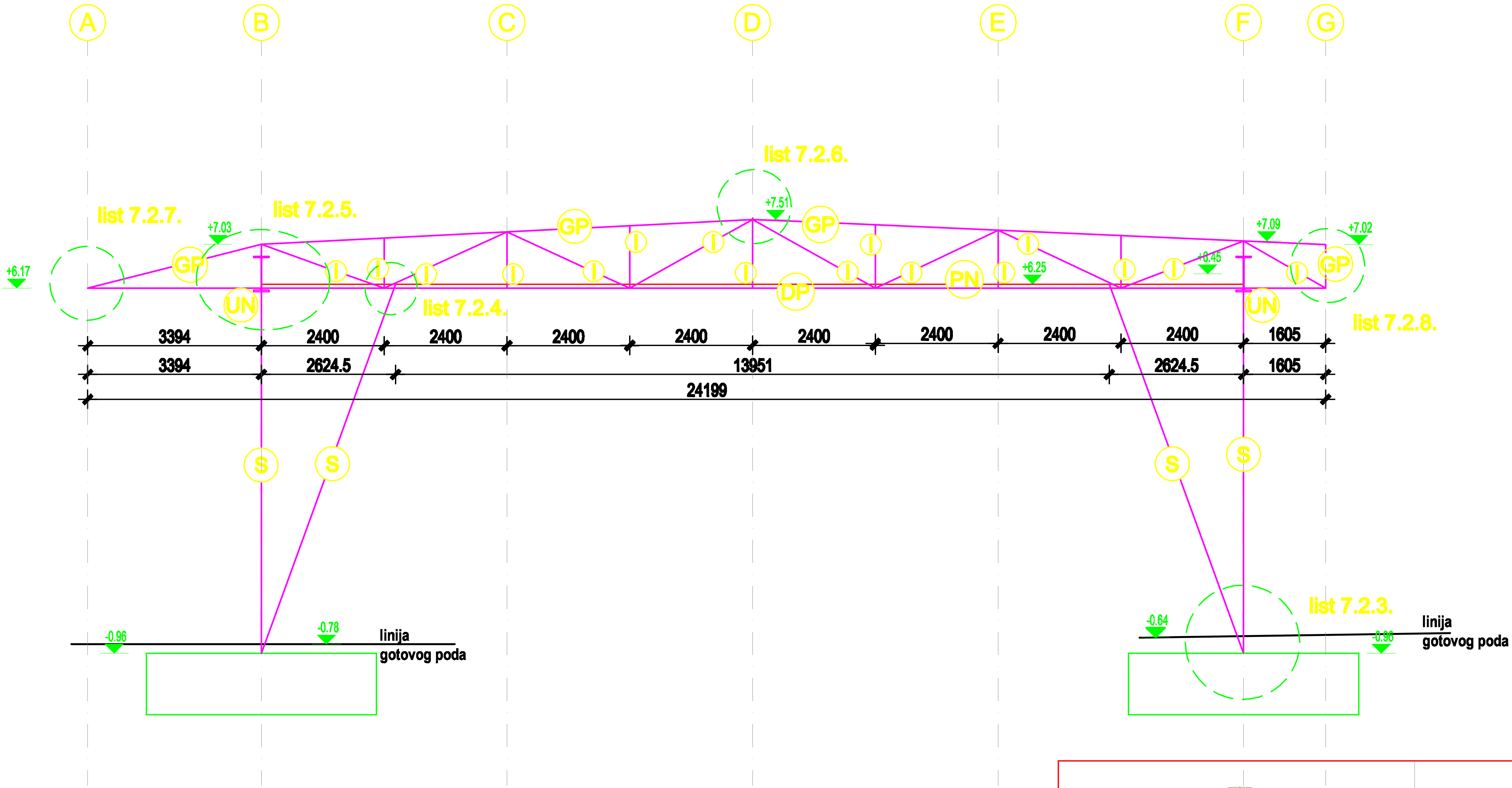
MENTOR:
**Prof.dr.sc. Bernardin Peroš**


FAZA PROJEKTA:
**GLAVNI PROJEKT**

SADRŽAJ:
**7.1. GRAĐEVINSKI NACRTI: KONSTRUKCIJA JUŽNE NADSTREŠNICE**

DATUM:
lipanj, 2015. god.

**list 7.1.1.**




| | |
|---|---|
| R1 | DP1 140x140x4 |
| | I1 90x90x4 |
| R2 | GP2 140x140x5 |
| | DP2 140x140x7.1 |
| | I2 90x90x5 |
| R3 | GP3 140x140x10 |
| | DP3 140x140x10 |
| | I3 90x90x6 |
| R4 | GP4 140x140x6 |
| | DP4 140x140x8 |
| | I4 90x900x5 |
| R5 | GP5 140x140x10 |
| | DP5 140x140x10 |
| | I5 90x90x6 |

UN HEA 700
PN HEA 300
UV 90x90x4
S 273x8
D Ø16


FAKULTET GRAĐEVINARSTVA, ARHITEKTURE I GEODEZIJE
KATEDRA ZA METALNE I DRVENE KONSTRUKCIJE
21000 SPLIT, MATICE HRVATSKE 15


SADRŽAJ LISTA:

# PLAN POZICIJA - POPREČNI PRESJEK NADSTREŠNICE

M 1:100

GRAĐEVINA:
**Pristanišna zgrada zračne luke Dubrovnik Zgrada "ABC" - Sortirnica / Putnički terminal**

PROJEKT:
**Građenje južne nadstrešnice ispred zgrade "B" i zgrade "C"**


STUDENT:
**Mario Šarčević**

MENTOR:
**Prof.dr.sc. Bernardin Peroš**


FAZA PROJEKTA:
**GLAVNI PROJEKT**

SADRŽAJ:
**7.1. GRAĐEVINSKI NACRTI: KONSTRUKCIJA JUŽNE NADSTREŠNICE**

DATUM:
lipanj, 2015. god.


| | | | | of element (kg) | Total (kg) |
|---|---|---|---|---|---|
| 1 | Sub part - profile L 110x110x10 | 20 | 626,00 | 10,39 | 207,83 |
| 2 | Sub part - profile L 110x110x10 | 20 | 626,00 | 10,39 | 207,83 |
| D 1 | D ROND 16 | 100 | 2130,00 | 4,24 | 423,61 |
| D 2 | D ROND 16 | 8 | 3470,00 | 6,35 | 50,83 |
| D 3 | D ROND 16 | 8 | 3830,00 | 6,92 | 55,38 |
| D 4 | D ROND 16 | 24 | 4080,00 | 7,32 | 175,61 |
| D 5 | D ROND 16 | 24 | 4430,00 | 7,87 | 188,88 |
| D 6 | D ROND 16 | 8 | 4510,00 | 8,00 | 63,97 |
| D 7 | D ROND 16 | 4 | 4560,00 | 8,08 | 32,30 |
| D 8 | D ROND 16 | 12 | 5080,00 | 8,90 | 106,76 |
| D 9 | D ROND 16 | 8 | 5130,00 | 8,98 | 71,81 |
| D 10 | D ROND 16 | 4 | 5780,00 | 10,00 | 40,01 |
| KR 1 | KR Q 140x140x5 | 3 | 3370,97 | 151,01 | 453,03 |
| KR 2 | KR Q 140x140x5 | 10 | 3370,97 | 185,99 | 1859,90 |
| KR 3 | KR Q 140x140x5 | 4 | 3370,97 | 186,87 | 747,47 |
| KR 4 | KR Q 140x140x5 | 4 | 3370,97 | 186,87 | 747,47 |
| KR 5 | KR Q 140x140x5 | 1 | 3370,97 | 186,90 | 186,90 |
| KR 6 | KR Q 140x140x6 | 5 | 3370,97 | 198,87 | 994,36 |
| KR 7 | KR Q 140x140x6 | 3 | 3370,97 | 199,78 | 599,34 |
| KR 8 | KR Q 140x140x6 | 2 | 3370,97 | 199,78 | 399,56 |
| KR 9 | KR Q 140x140x10 | 2 | 3370,97 | 266,88 | 533,77 |
| KR 10 | KR Q 140x140x10 | 1 | 3370,97 | 267,79 | 267,79 |
| KR 11 | KR Q 140x140x10 | 1 | 3370,97 | 267,79 | 267,79 |
| KR 12 | KR Q 140x140x10 | 2 | 3370,97 | 267,83 | 535,65 |
| KR 13 | KR Q 140x140x10 | 2 | 3370,97 | 267,83 | 535,65 |
| PN 1 | PN HEA 300 | 20 | 6000,00 | 541,72 | 10834,36 |
| PN 2 | PN HEA 300 | 10 | 7140,00 | 630,71 | 6307,07 |
| Pl 1 | Plate Plate 6x200 | 40 | 200,00 | 1,81 | 72,58 |
| Pl 2 | Plate Plate 8x300 | 40 | 340,00 | 6,22 | 248,87 |
| Pl 3 | Plate Plate 8x115 | 80 | 340,00 | 2,36 | 189,06 |
| Pl 4 | Plate Plate 16x300 | 64 | 560,00 | 20,33 | 1301,01 |
| Pl 5 | Plate Plate 16x115 | 128 | 560,00 | 7,70 | 985,79 |
| Pl 6 | Plate Plate 10x240 | 64 | 560,00 | 10,32 | 660,58 |
| Pl 7 | Plate Plate 20x693 | 20 | 701,54 | 127,64 | 2552,73 |
| R 1 | R Q 140x140x5 | 3 | 21053,54 | 1240,70 | 3722,10 |
| R 2 | R Q 140x140x8 | 10 | 21053,54 | 1529,47 | 15294,70 |
| R 3 | R Q 140x140x8 | 4 | 21053,54 | 1537,43 | 6149,73 |
| R 4 | R Q 140x140x8 | 4 | 21053,54 | 1537,43 | 6149,73 |
| R 5 | R Q 140x140x8 | 1 | 21053,54 | 1537,64 | 1537,64 |
| R 6 | R Q 140x140x8 | 5 | 21053,54 | 1614,33 | 8071,63 |
| R 7 | R Q 140x140x8 | 2 | 21053,54 | 1622,50 | 3245,00 |
| R 8 | R Q 140x140x8 | 3 | 21053,54 | 1622,50 | 4867,50 |
| R 9 | R Q 140x140x10 | 2 | 21053,54 | 2123,97 | 4247,95 |
| R 10 | R Q 140x140x10 | 1 | 21053,54 | 2132,15 | 2132,15 |
| R 11 | R Q 140x140x10 | 1 | 21053,54 | 2132,15 | 2132,15 |
| R 12 | R Q 140x140x10 | 2 | 21053,54 | 2132,38 | 4264,75 |
| R 13 | R Q 140x140x10 | 2 | 21053,54 | 2132,38 | 4264,75 |
| S 1 | S CHS 273x8 | 20 | 7181,18 | 425,62 | 8512,33 |
| S 2 | S CHS 273x8 | 20 | 7181,23 | 425,62 | 8512,33 |
| S 3 | S CHS 273x8 | 20 | 7184,07 | 425,62 | 8512,34 |
| UN 1 | UN HEA 700 | 2 | 3280,01 | 670,68 | 1341,36 |
| UN 2 | UN HEA 700 | 6 | 8000,00 | 1696,90 | 10181,38 |
| UN 3 | UN HEA 700 | 2 | 8000,00 | 1696,90 | 3393,79 |
| UN 4 | UN HEA 700 | 2 | 10000,00 | 2148,87 | 4297,74 |
| UN 5 | UN HEA 700 | 1 | 10000,00 | 2165,81 | 2165,81 |
| UN 6 | UN HEA 700 | 6 | 10000,00 | 2105,85 | 12635,08 |
| UN 7 | UN HEA 700 | 2 | 10000,00 | 2148,87 | 4297,74 |
| UN 8 | UN HEA 700 | 2 | 10000,00 | 2148,87 | 4297,74 |
| UN 9 | UN HEA 700 | 2 | 10000,00 | 2148,87 | 4297,74 |
| UN 10 | UN HEA 700 | 1 | 10000,00 | 2148,87 | 2148,87 |
| UN 11 | UN HEA 700 | 1 | 10000,00 | 2148,87 | 2148,87 |
| UN 12 | UN HEA 700 | 1 | 10000,00 | 2165,81 | 2165,81 |
| UN 13 | UN HEA 700 | 1 | 11000,00 | 2383,89 | 2383,89 |
| UN 14 | UN HEA 700 | 1 | 11000,00 | 2383,89 | 2383,89 |
| UN 15 | UN HEA 700 | 1 | 12480,01 | 2686,52 | 2686,52 |
| UN 16 | UN HEA 700 | 1 | 12480,01 | 2686,52 | 2686,52 |
| UN 17 | UN HEA 700 | 1 | 15000,00 | 3232,34 | 3232,34 |
| UN 18 | UN HEA 700 | 1 | 15000,00 | 3232,34 | 3232,34 |
| UN 19 | UN HEA 700 | 1 | 15000,00 | 3249,28 | 3249,28 |
| UN 20 | UN HEA 700 | 1 | 15000,00 | 3249,28 | 3249,28 |
| Total mass: (kg) | | | | | 200998,36 |
| Element mass: (kg) | | | | 74951,54 | |
| Weld mass addition (kg) | | | | | 4019,97 |
| Total mass (kg) | | | | | 205018,33 |

***PROTUPOŽARNA I ANTIKOROZIVNA ZAŠTITA: PREMAZIVANJE***

ZAHTJEV TRAJNOSTI ANTIKOROZIVNE ZAŠTITE: HIGH DURABILITY ( prema HRN EN ISO 12944-1:1998)

AGRESIVNOST SREDINE: C1 - LOW (prema tablici 1 iz HRN EN ISO 12944-2:1998)

ZAHTJEV PROTUPOŽARNE OTPORNOSTI:

SADRŽAJ LISTA:

# PLAN POZICIJA

M 1:100

FAKULTET GRAĐEVINARSTVA, ARHITEKTURE I GEODEZIJE
KATEDRA ZA METALNE I DRVENE KONSTRUKCIJE
21000 SPLIT, MATICE HRVATSKE 15

GRAĐEVINA:
Pristanišna zgrada zračne luke Dubrovnik
Zgrada "ABC" - Sortirnica / Putnički terminal

PROJEKT:
Građenje južne nadstrešnice ispred zgrade "B" i zgrade "C"

STUDENT:
Mario Šarčević

MENTOR:
Prof.dr.sc. Bernardin Peroš

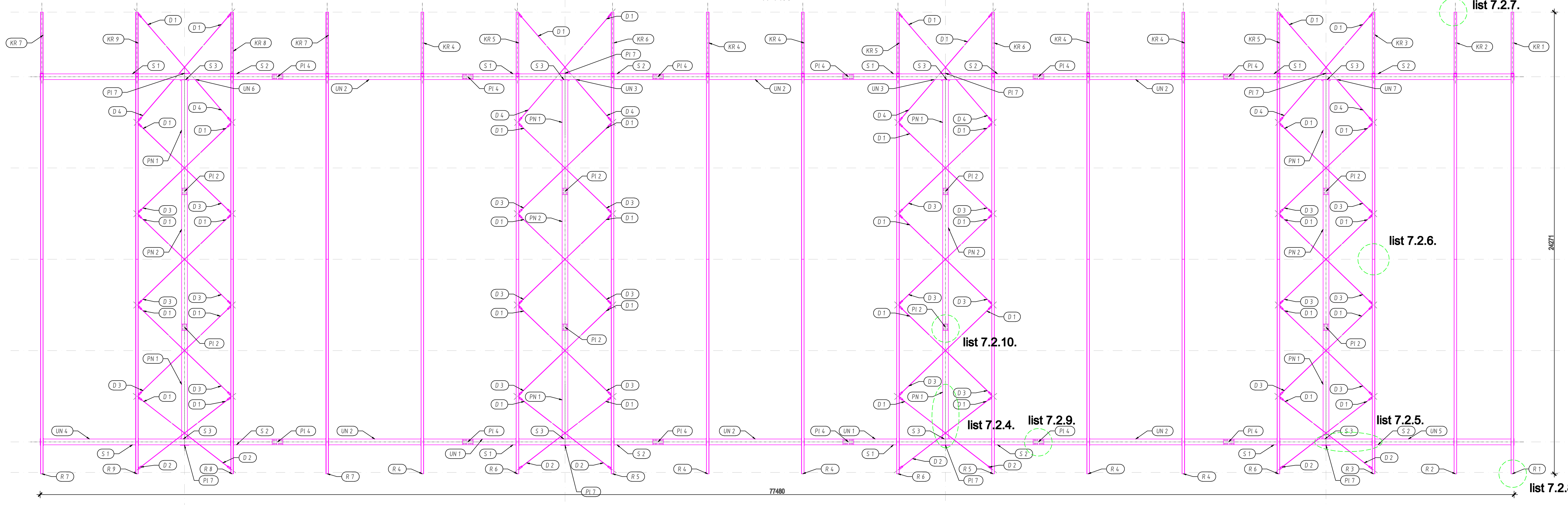
FAZA PROJEKTA:
IZVEDBENI PROJEKT

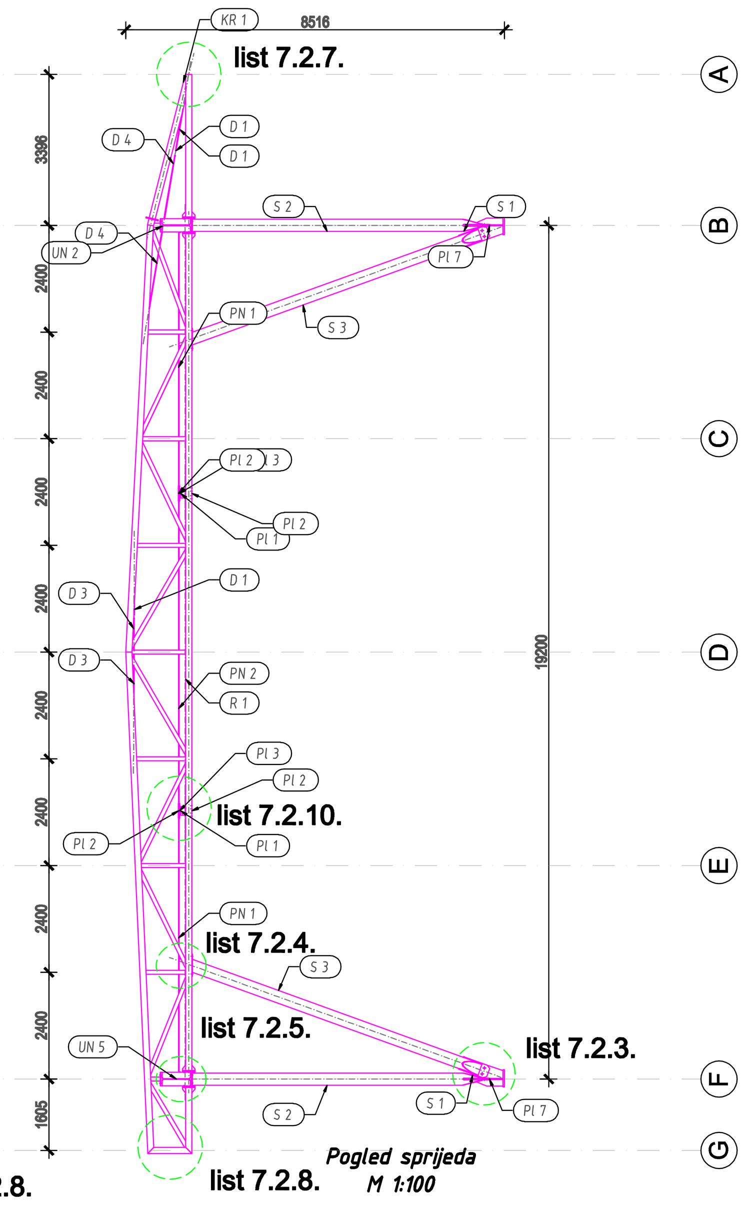
SADRŽAJ:
7.2. GRAĐEVINSKI NACRTI: KONSTRUKCIJA JUŽNE NADSTREŠNICE

DATUM:
lipanj, 2015. god.

list 7.2.1.

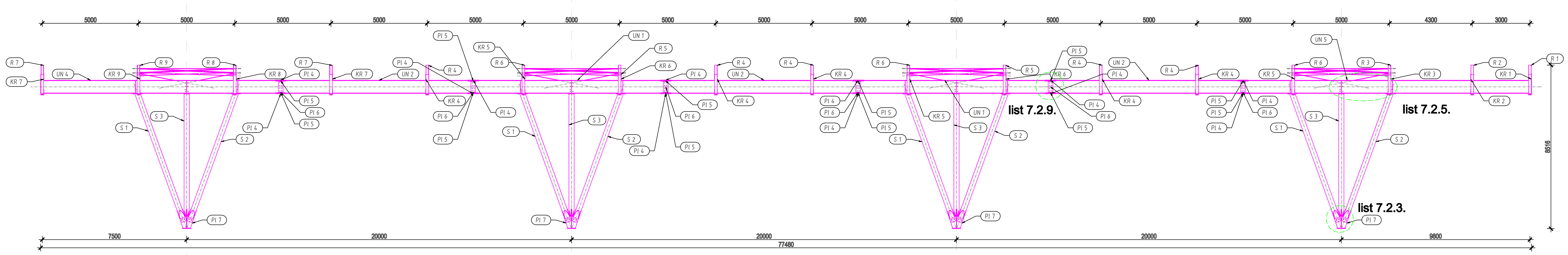
Pogled odozgo
M 1:100



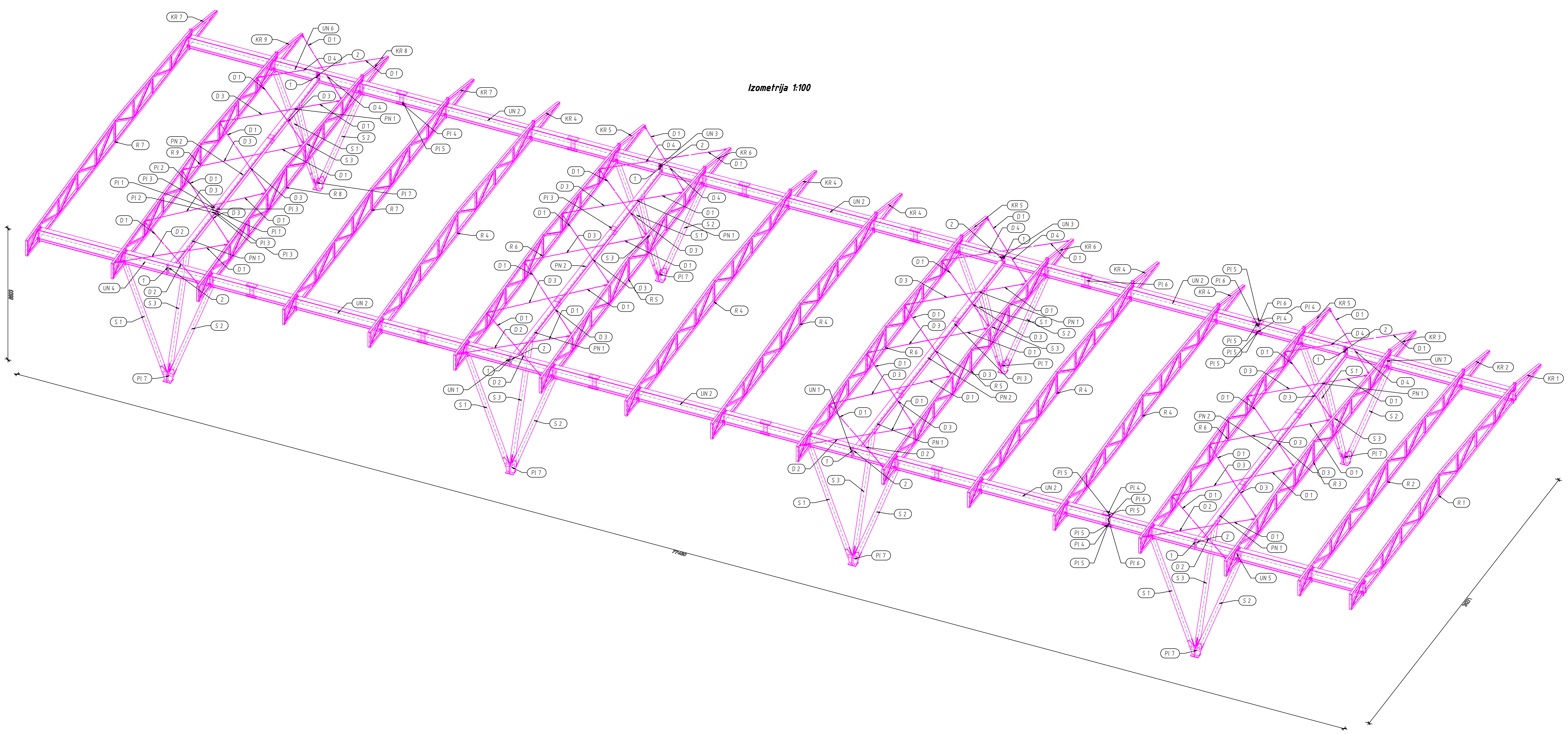




Pogled sprijeda
M 1:100

Pogled sa strane
M 1:100




Izometrija 1:100



| Position | Element name | Number | Length (mm) | Mass | |
|---|---|---|---|---|---|
| | | | | of element (kg) | Total (kg) |
| 1 | Sub part - profile L 110x110x10 | 8 | 626,00 | 10,39 | 83,13 |
| 2 | Sub part - profile L 110x110x10 | 8 | 626,00 | 10,39 | 83,13 |
| D 1 | D ROND 16 | 40 | 2130,00 | 4,24 | 169,44 |
| D 2 | D ROND 16 | 8 | 3830,00 | 6,92 | 55,38 |
| D 3 | D ROND 16 | 24 | 4430,00 | 7,87 | 188,88 |
| D 4 | D ROND 16 | 8 | 5130,00 | 8,98 | 71,81 |
| KR 1 | KR Q 140x140x5 | 1 | 3370,97 | 151,01 | 151,01 |
| KR 2 | KR Q 140x140x5 | 1 | 3370,97 | 185,99 | 185,99 |
| KR 3 | KR Q 140x140x5 | 1 | 3370,97 | 186,90 | 186,90 |
| KR 4 | KR Q 140x140x6 | 5 | 3370,97 | 198,87 | 994,36 |
| KR 5 | KR Q 140x140x6 | 3 | 3370,97 | 199,78 | 599,34 |
| KR 6 | KR Q 140x140x6 | 2 | 3370,97 | 199,78 | 399,56 |
| KR 7 | KR Q 140x140x10 | 2 | 3370,97 | 266,88 | 533,77 |
| KR 8 | KR Q 140x140x10 | 1 | 3370,97 | 267,79 | 267,79 |
| KR 9 | KR Q 140x140x10 | 1 | 3370,97 | 267,79 | 267,79 |
| PN 1 | PN HEA 300 | 8 | 6000,00 | 541,72 | 4333,74 |
| PN 2 | PN HEA 300 | 4 | 7140,00 | 630,71 | 2522,83 |
| Pl 1 | Plate Plate 6x200 | 16 | 200,00 | 1,81 | 29,03 |
| Pl 2 | Plate Plate 8x300 | 16 | 340,00 | 6,22 | 99,55 |
| Pl 3 | Plate Plate 8x115 | 32 | 340,00 | 2,36 | 75,62 |
| Pl 4 | Plate Plate 16x300 | 24 | 560,00 | 20,33 | 487,88 |
| Pl 5 | Plate Plate 16x115 | 48 | 560,00 | 7,70 | 369,67 |
| Pl 6 | Plate Plate 10x240 | 24 | 560,00 | 10,32 | 247,72 |
| Pl 7 | Plate Plate 20x693 | 8 | 701,54 | 127,64 | 1021,09 |
| R 1 | R Q 140x140x5 | 1 | 21053,54 | 1240,70 | 1240,70 |
| R 2 | R Q 140x140x8 | 1 | 21053,54 | 1529,47 | 1529,47 |
| R 3 | R Q 140x140x8 | 1 | 21053,54 | 1537,64 | 1537,64 |
| R 4 | R Q 140x140x8 | 5 | 21053,54 | 1614,33 | 8071,63 |
| R 5 | R Q 140x140x8 | 2 | 21053,54 | 1622,50 | 3245,00 |
| R 6 | R Q 140x140x8 | 3 | 21053,54 | 1622,50 | 4867,50 |
| R 7 | R Q 140x140x10 | 2 | 21053,54 | 2123,97 | 4247,95 |
| R 8 | R Q 140x140x10 | 1 | 21053,54 | 2132,15 | 2132,15 |
| R 9 | R Q 140x140x10 | 1 | 21053,54 | 2132,15 | 2132,15 |
| S 1 | S CHS 273x8 | 8 | 7181,18 | 425,62 | 3404,93 |
| S 2 | S CHS 273x8 | 8 | 7181,23 | 425,62 | 3404,93 |
| S 3 | S CHS 273x8 | 8 | 7184,07 | 425,62 | 3404,94 |
| UN 1 | UN HEA 700 | 2 | 10000,00 | 2148,87 | 4297,74 |
| UN 2 | UN HEA 700 | 6 | 10000,00 | 2105,85 | 12635,08 |
| UN 3 | UN HEA 700 | 2 | 10000,00 | 2148,87 | 4297,74 |
| UN 4 | UN HEA 700 | 1 | 12480,01 | 2686,52 | 2686,52 |
| UN 5 | UN HEA 700 | 1 | 15000,00 | 3232,34 | 3232,34 |
| UN 6 | UN HEA 700 | 1 | 12480,01 | 2686,52 | 2686,52 |
| UN 7 | UN HEA 700 | 1 | 15000,00 | 3232,34 | 3232,34 |
| Total mass: (kg) | | | | | 85712,68 |
| Element mass: (kg) | | | | 38395,95 | |
| Weld mass addition (kg) | | | | | 1714,25 |
| Total mass (kg) | | | | | 87426,93 |

***PROTUPOŽARNA I ANTIKOROZIVNA ZAŠTITA: PREMAZIVANJE***

ZAHTJEV TRAJNOSTI ANTIKOROZIVNE ZAŠTITE: HIGH DURABILITY ( prema HRN EN ISO 12944-1:1998)

AGRESIVNOST SREDINE: C1 - LOW (prema tablici 1 iz HRN EN ISO 12944-2:1998)

ZAHTJEV PROTUPOŽARNE OTPORNOSTI:

SVEUČILIŠTE U SPLITU
FAKULTET GRAĐEVINARSTVA, ARHITEKTURE I GEODEZIJE
KATEDRA ZA METALNE I DRVENE KONSTRUKCIJE
21000 SPLIT, MATICE HRVATSKE 15

SADRŽAJ LISTA:

# PLAN POZICIJA - DILATACIJA C1

M 1:100

GRAĐEVINA:
**Pristanišna zgrada zračne luke Dubrovnik Zgrada "ABC" - Sortirnica / Putnički terminal**

PROJEKT:
**Građenje južne nadstrešnice ispred zgrade "B" i zgrade "C"**

STUDENT:
**Mario Šarčević**

MENTOR:
**Prof.dr.sc. Bernardin Peroš**

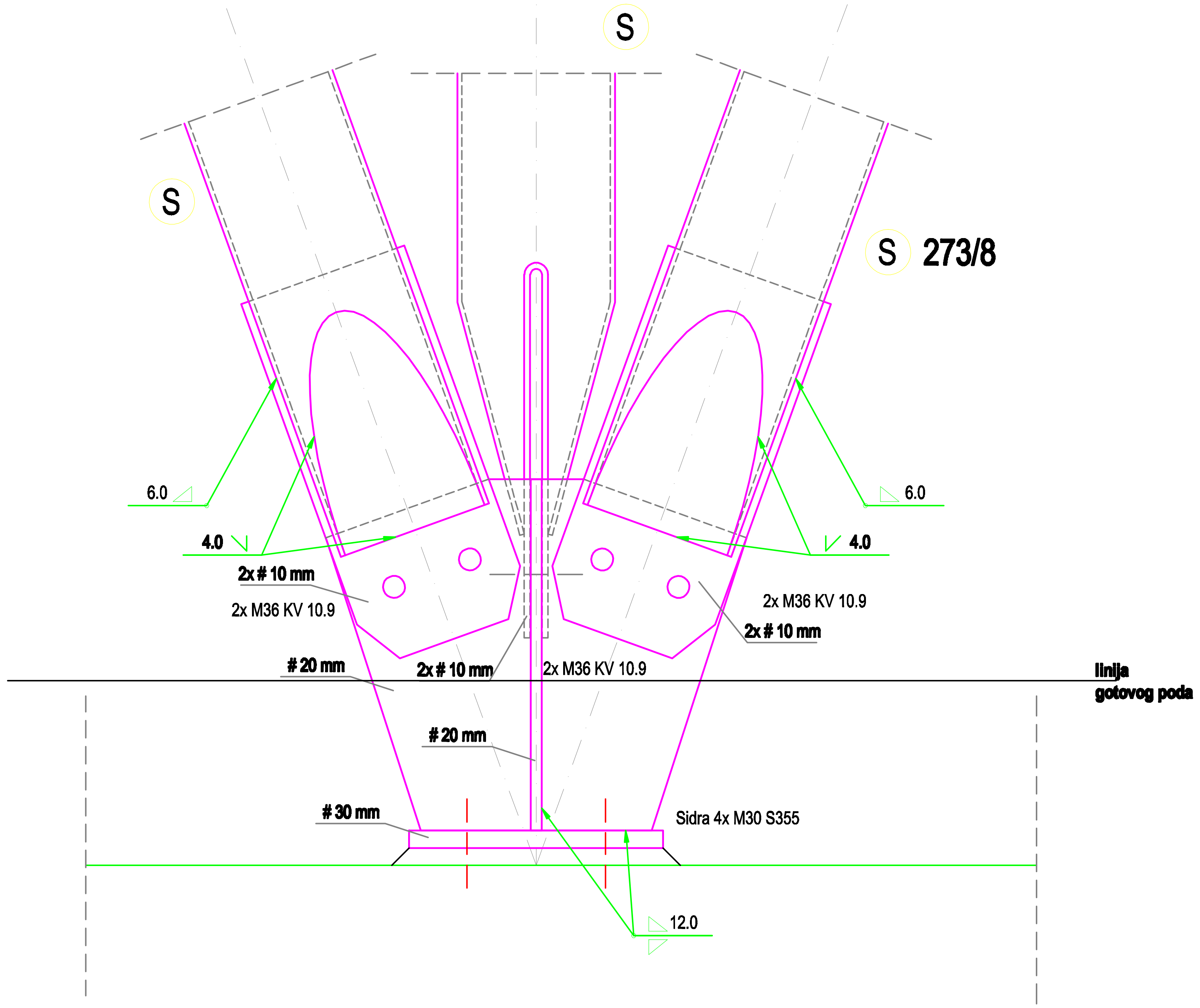
FAZA PROJEKTA:
**IZVEDBENI PROJEKT**

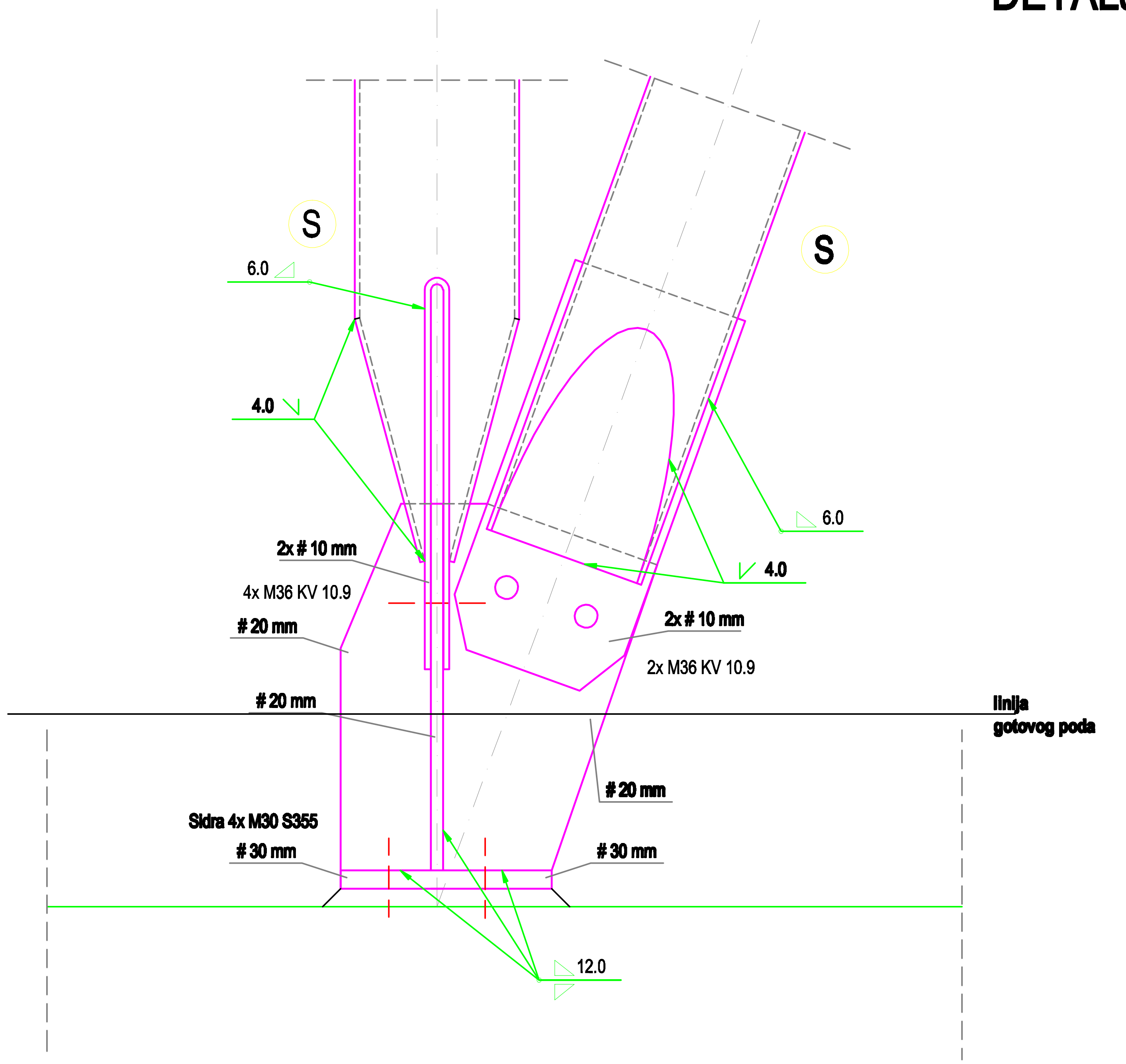
SADRŽAJ:
**7.2. GRAĐEVINSKI NACRTI: KONSTRUKCIJA JUŽNE NADSTREŠNICE**

DATUM:
lipanj, 2015. god.

list **7.2.2.**

DETALJ SPOJA STUPOVA I TEMELJA

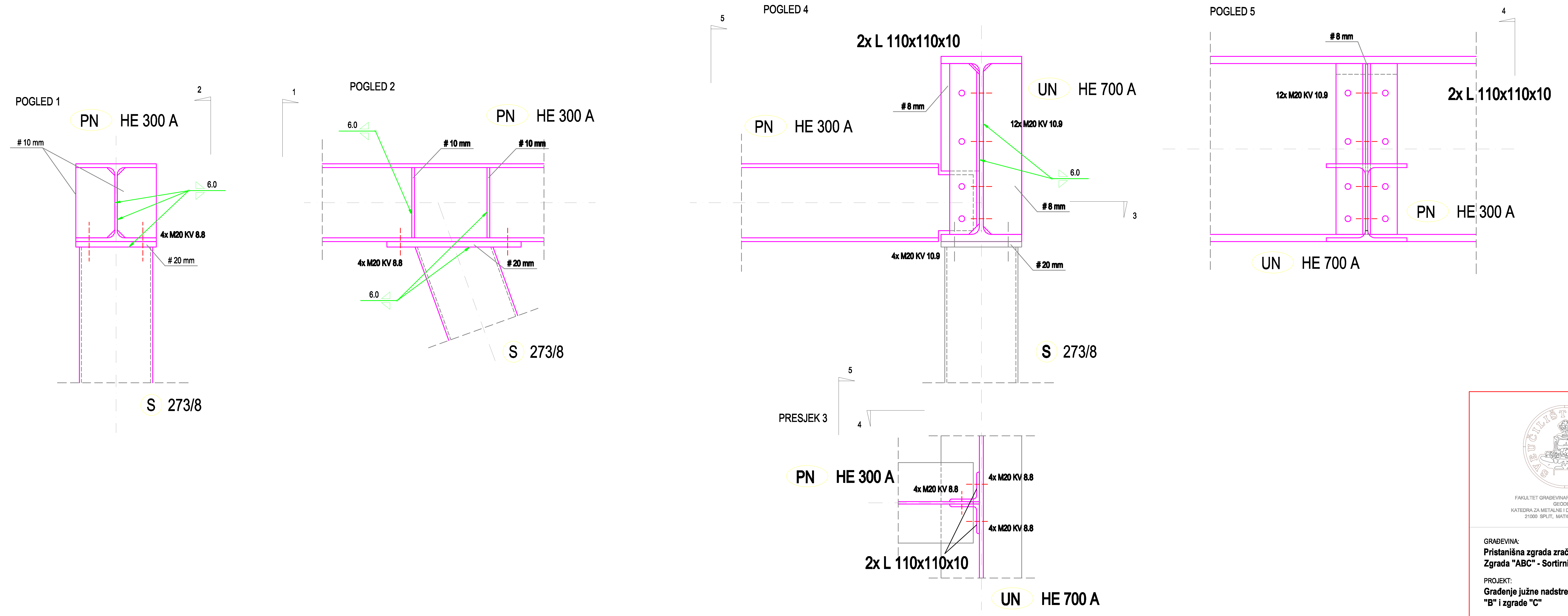



Napomena:
Debljina vara u čvorovima rešetke se mijenja s obzirom na debljine stijenki cijevi u čvoru. Varove uvijek izvoditi sa debljinom t=0,7x(minimalna debljina stijenke u spoju)

| | | |
|---|---|---|
| FAKULTET GRAĐEVINARSTVA, ARHITEKTURE I GEODEZIJE<br>KATEDRA ZA METALNE I DRVENE KONSTRUKCIJE<br>21000 SPLIT, MATICE HRVATSKE 15 | SADRŽAJ LISTA:<br>**DETALJ SPOJA STUPOVA I TEMELJA**<br>M 1:10 | |
| GRAĐEVINA:<br>**Pristanišna zgrada zračne luke Dubrovnik Zgrada "ABC" - Sortirnica / Putnički terminal**<br>PROJEKT:<br>**Građenje južne nadstrešnice ispred zgrade "B" i zgrade "C"** | STUDENT:<br>**Mario Šarčević**<br>MENTOR:<br>**Prof.dr.sc. Bernardin Peroš**<br>FAZA PROJEKTA:<br>**IZVEDBENI PROJEKT** | SADRŽAJ:<br>**7.2. GRAĐEVINSKI NACRTI: KONSTRUKCIJA JUŽNE NADSTREŠNICE**<br>DATUM:<br>lipanj, 2015. god.<br>list **7.2.3.** |

# DETALJ OSLANJANJA POPREČNOG NOSAČA POZICIJE PN NA UZDUŽNI NOSAČ POZICIJE UN I DETALJ SPOJA STUPA I POPREČNOG NOSAČA




Napomena:
Debljina vara u čvorovima rešetke se mijenja s obzirom na debljine stijenki cijevi u čvoru.
Varove uvijek izvoditi sa debljinom t=0,7x(minimalna debljina stijenke u spoju)

FAKULTET GRAĐEVINARSTVA, ARHITEKTURE I GEODEZIJE
KATEDRA ZA METALNE I DRVENE KONSTRUKCIJE
21000 SPLIT, MATICE HRVATSKE 15

SADRŽAJ LISTA:
**DETALJ OSLANJANJA POPREČNOG NOSAČA POZICIJE PN NA UZDUŽNI NOSAČ POZICIJE UN I DETALJ SPOJA STUPA I POPREČNOG NOSAČA**
**M 1:10**

GRAĐEVINA:
**Pristanišna zgrada zračne luke Dubrovnik**
**Zgrada "ABC" - Sortirnica / Putnički terminal**

PROJEKT:
**Građenje južne nadstrešnice ispred zgrade "B" i zgrade "C"**

STUDENT:
**Mario Šarčević**

MENTOR:
**Prof.dr.sc. Bernardin Peroš**

FAZA PROJEKTA:
**IZVEDBENI PROJEKT**

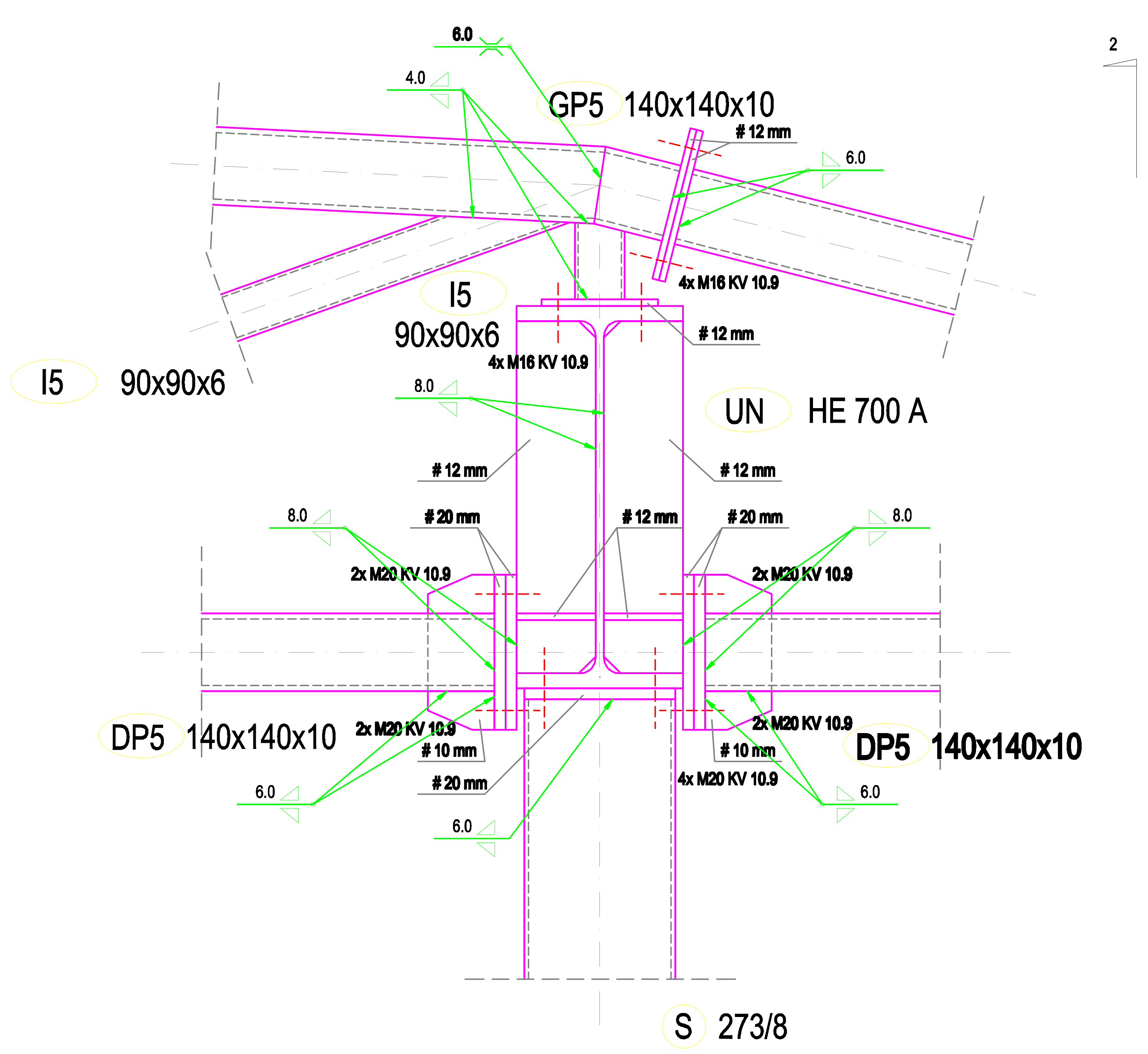
SADRŽAJ:
**7.2. GRAĐEVINSKI NACRTI: KONSTRUKCIJA JUŽNE NADSTREŠNICE**

DATUM:
lipanj, 2015. god.

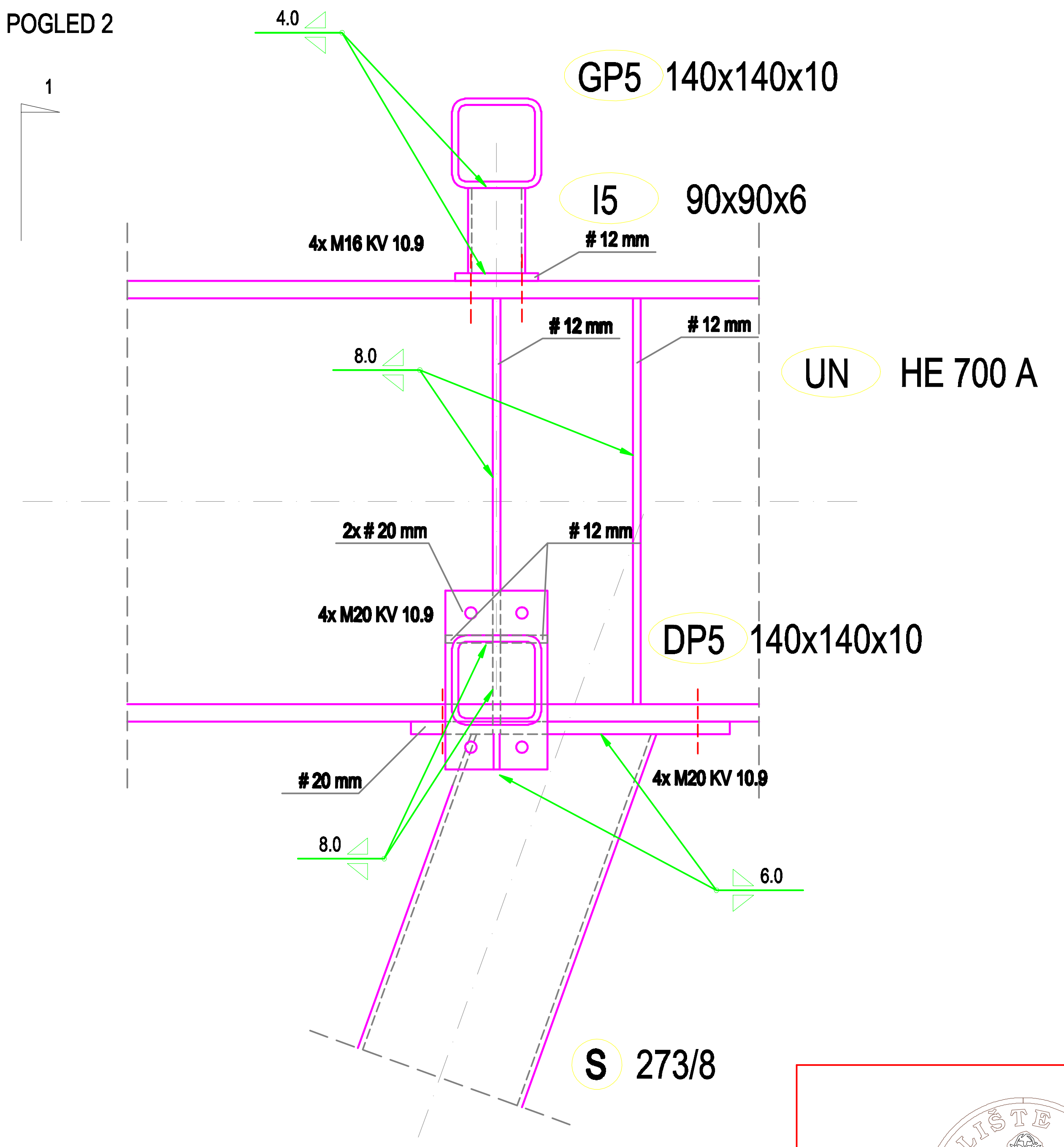
list **7.2.4.**

# DETALJ OSLANJANJA REŠETKE NA UZDUŽNI NOSAČ POZICIJE UN

POGLED 1




POGLED 2




Napomena:
Debljina vara u čvorovima rešetke se mijenja s obzirom na debljine stijenki cijevi u čvoru. Varove uvijek izvoditi sa debljinom t=0,7x(minimalna debljina stijenke u spoju)

SADRŽAJ LISTA:

## DETALJ OSLANJANJA REŠETKE NA UZDUŽNI NOSAČ POZICIJE UN

M 1:10


FAKULTET GRAĐEVINARSTVA, ARHITEKTURE I GEODEZIJE
KATEDRA ZA METALNE I DRVENE KONSTRUKCIJE
21000 SPLIT, MATICE HRVATSKE 15


GRAĐEVINA:
Pristanišna zgrada zračne luke Dubrovnik
Zgrada "ABC" - Sortirnica / Putnički terminal

PROJEKT:
Građenje južne nadstrešnice ispred zgrade "B" i zgrade "C"


STUDENT:
Mario Šarčević

MENTOR:
Prof.dr.sc. Bernardin Peroš

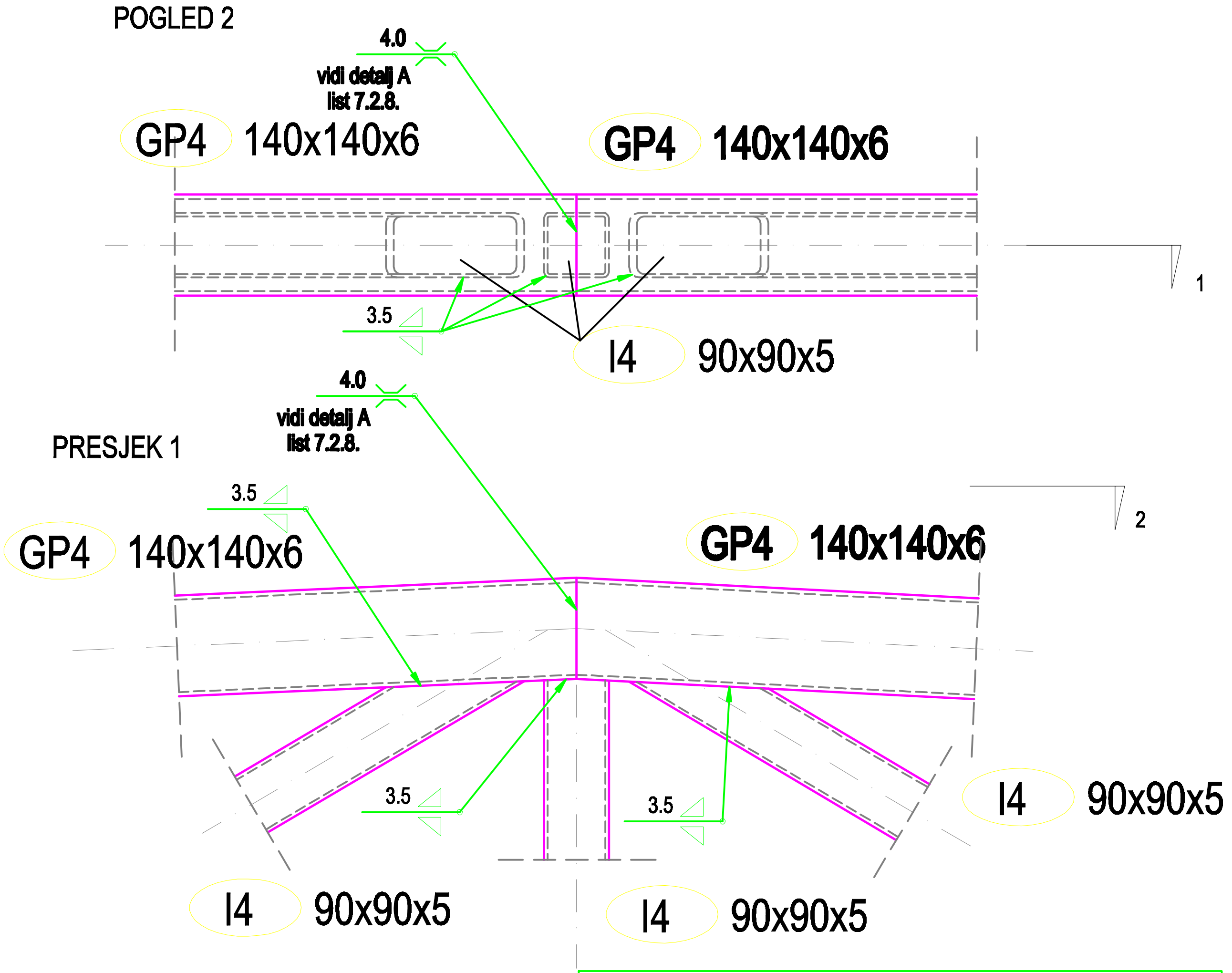

FAZA PROJEKTA:
IZVEDBENI PROJEKT

SADRŽAJ:
7.2. GRAĐEVINSKI NACRTI:
KONSTRUKCIJA JUŽNE NADSTREŠNICE

DATUM:
lipanj, 2015. god.

list 7.2.5.

# DETALJ ČVORA REŠETKE U OSI D




**Napomena:**
**Debljina vara u čvorovima rešetke se mijenja s obzirom na debljine stijenki cijevi u čvoru. Varove uvijek izvoditi sa debljinom t=0,7x(minimalna debljina stijenke u spoju)**

FAKULTET GRAĐEVINARSTVA, ARHITEKTURE I GEODEZIJE
KATEDRA ZA METALNE I DRVENE KONSTRUKCIJE
21000 SPLIT, MATICE HRVATSKE 15

SADRŽAJ LISTA:

## DETALJ ČVORA REŠETKE U OSI D

**M 1:10**

GRAĐEVINA:
**Pristanišna zgrada zračne luke Dubrovnik**
**Zgrada "ABC" - Sortirnica / Putnički terminal**

PROJEKT:
**Građenje južne nadstrešnice ispred zgrade "B" i zgrade "C"**

STUDENT:
**Mario Šarčević**

MENTOR:
**Prof.dr.sc. Bernardin Peroš**

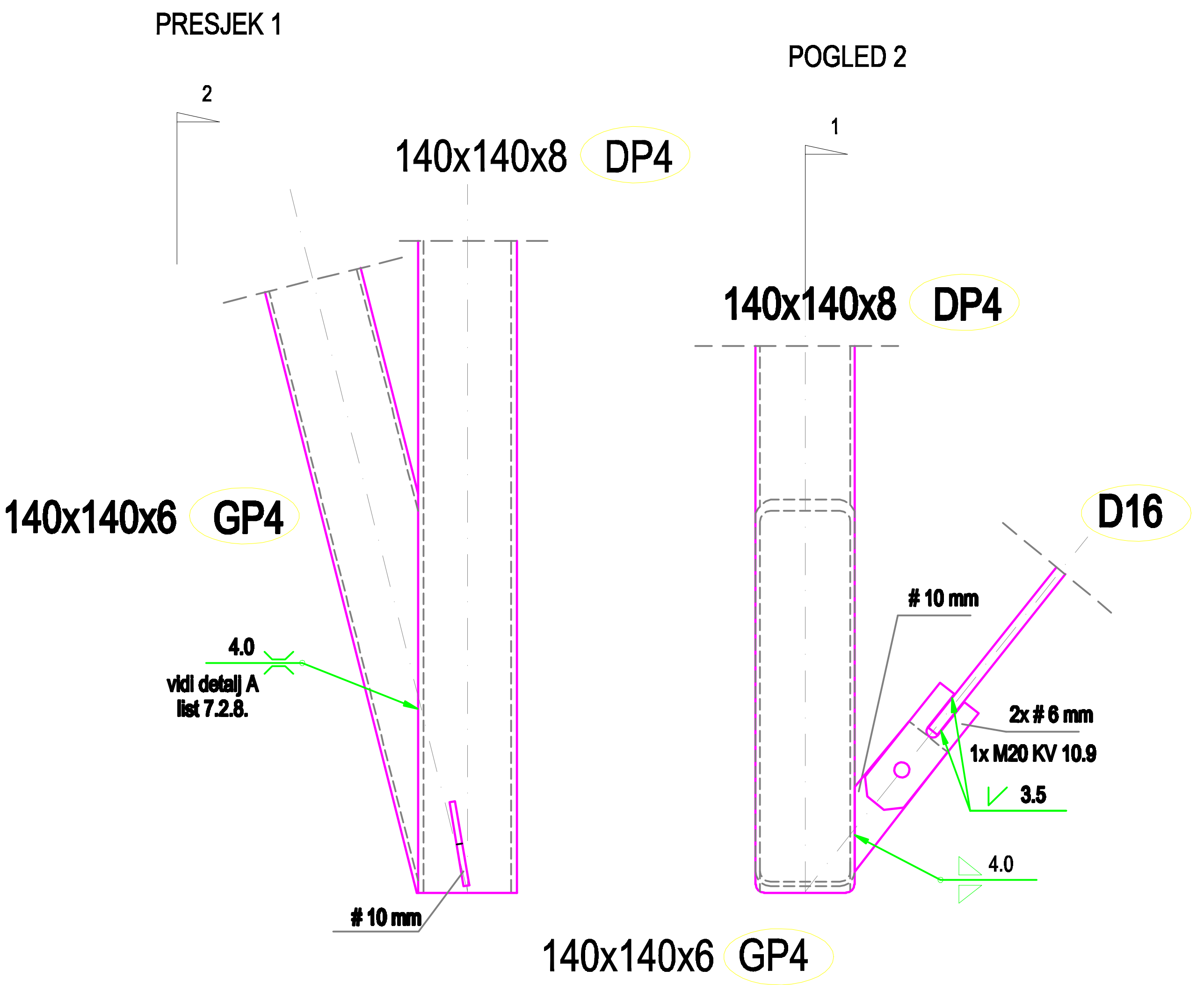
FAZA PROJEKTA:
**IZVEDBENI PROJEKT**

SADRŽAJ:
**7.2. GRAĐEVINSKI NACRTI: KONSTRUKCIJA JUŽNE NADSTREŠNICE**

DATUM:
lipanj, 2015. god.

list **7.2.6.**

# DETALJ ČVORA REŠETKE U OSI A




**Napomena:**
**Debljina vara u čvorovima rešetke se mijenja s obzirom na debljine stijenki cijevi u čvoru. Varove uvijek izvoditi sa debljinom t=0,7x(minimalna debljina stijenke u spoju)**

FAKULTET GRAĐEVINARSTVA, ARHITEKTURE I GEODEZIJE
KATEDRA ZA METALNE I DRVENE KONSTRUKCIJE
21000 SPLIT, MATICE HRVATSKE 15

SADRŽAJ LISTA:

**DETALJ ČVORA REŠETKE U OSI A**

**M 1:10**

GRAĐEVINA:
**Pristanišna zgrada zračne luke Dubrovnik**
**Zgrada "ABC" - Sortirnica / Putnički terminal**

PROJEKT:
**Građenje južne nadstrešnice ispred zgrade "B" i zgrade "C"**

STUDENT:
**Mario Šarčević**

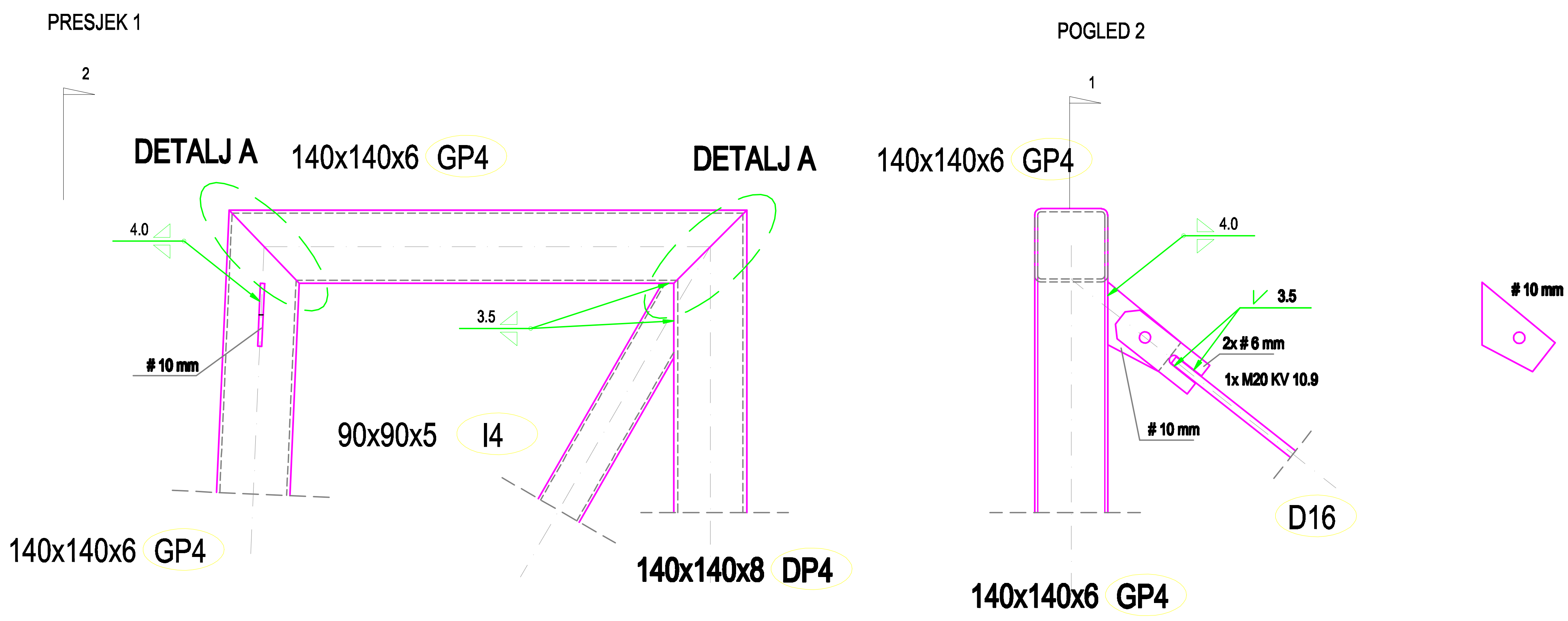
MENTOR:
**Prof.dr.sc. Bernardin Peroš**

FAZA PROJEKTA:
**IZVEDBENI PROJEKT**

SADRŽAJ:
**7.2. GRAĐEVINSKI NACRTI: KONSTRUKCIJA JUŽNE NADSTREŠNICE**

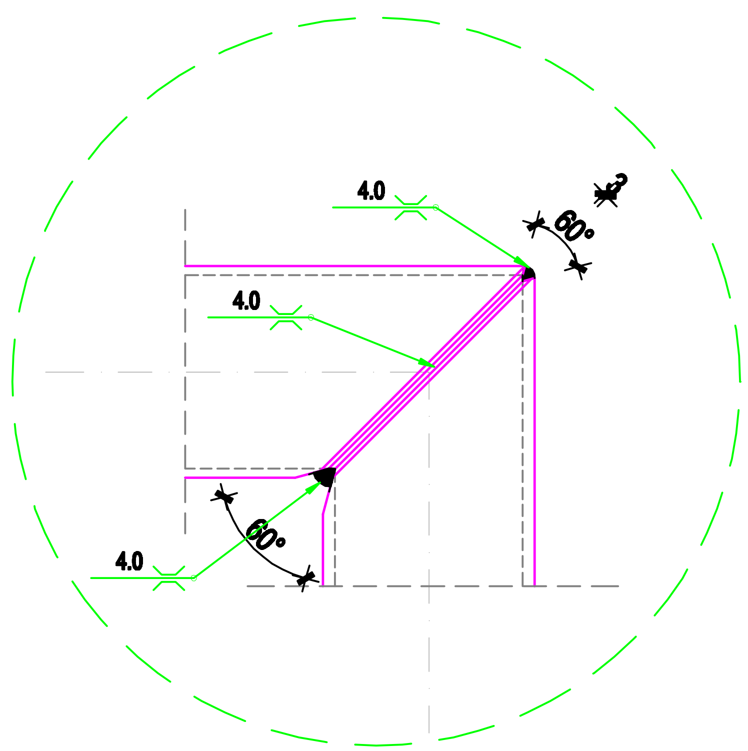
DATUM:
lipanj, 2015. god.

**list 7.2.7.**




**Napomena:**
**Debljina vara u čvorovima rešetke se mijenja s obzirom na debljine stijenki cijevi u čvoru. Varove uvijek izvoditi sa debljinom t=0,7x(minimalna debljina stijenke u spoju)**

## DETALJ A M 1:5




FAKULTET GRAĐEVINARSTVA, ARHITEKTURE I GEODEZIJE
KATEDRA ZA METALNE I DRVENE KONSTRUKCIJE
21000 SPLIT, MATICE HRVATSKE 15

SADRŽAJ LISTA:

# DETALJ ČVORA REŠETKE U OSI G

M 1:10

GRAĐEVINA:
**Pristanišna zgrada zračne luke Dubrovnik**
**Zgrada "ABC" - Sortirnica / Putnički terminal**

PROJEKT:
**Građenje južne nadstrešnice ispred zgrade "B" i zgrade "C"**

STUDENT:
**Mario Šarčević**

MENTOR:
**Prof.dr.sc. Bernardin Peroš**

FAZA PROJEKTA:
**IZVEDBENI PROJEKT**

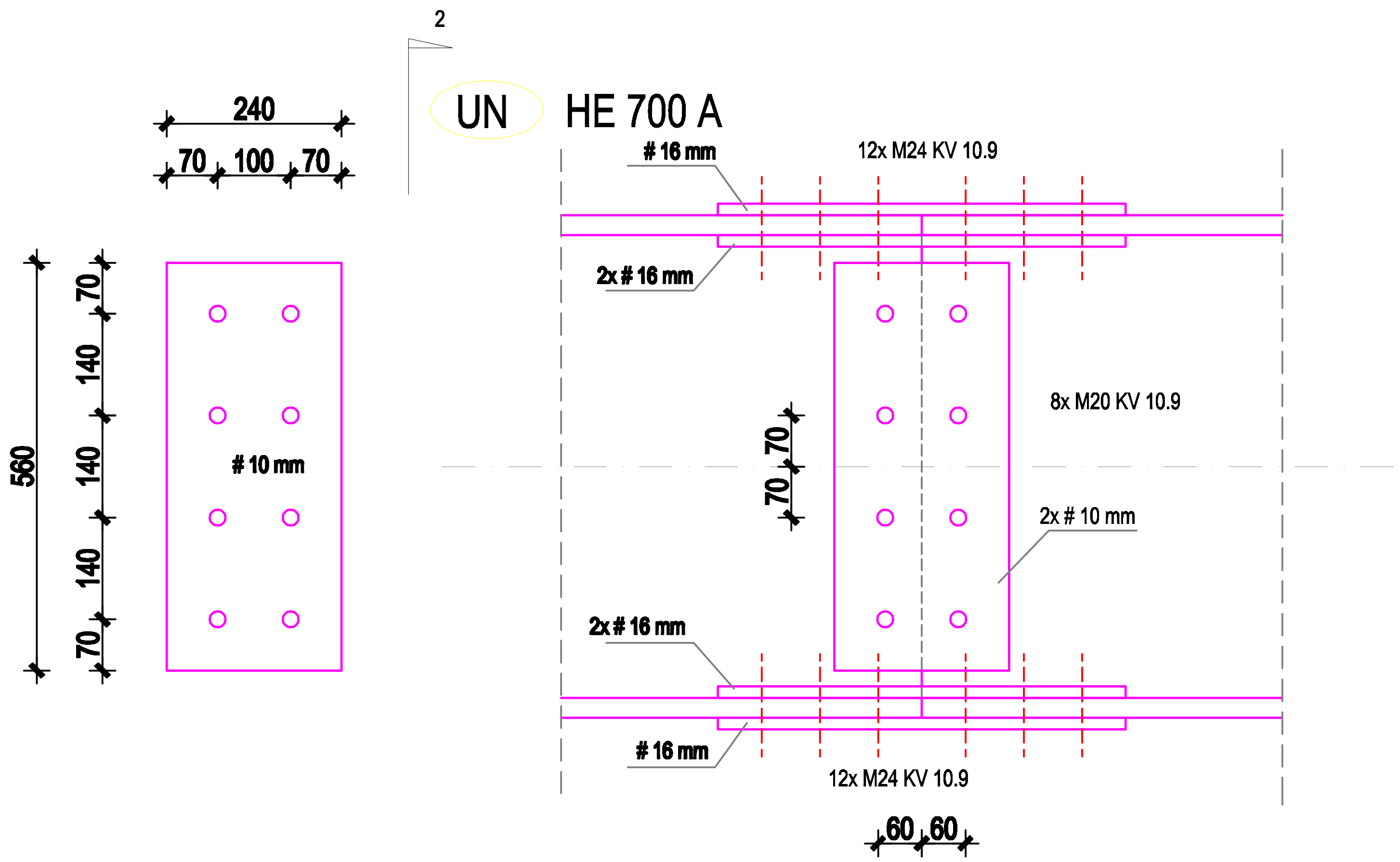
SADRŽAJ:
**7.2. GRAĐEVINSKI NACRTI: KONSTRUKCIJA JUŽNE NADSTREŠNICE**

DATUM:
lipanj, 2015. god.

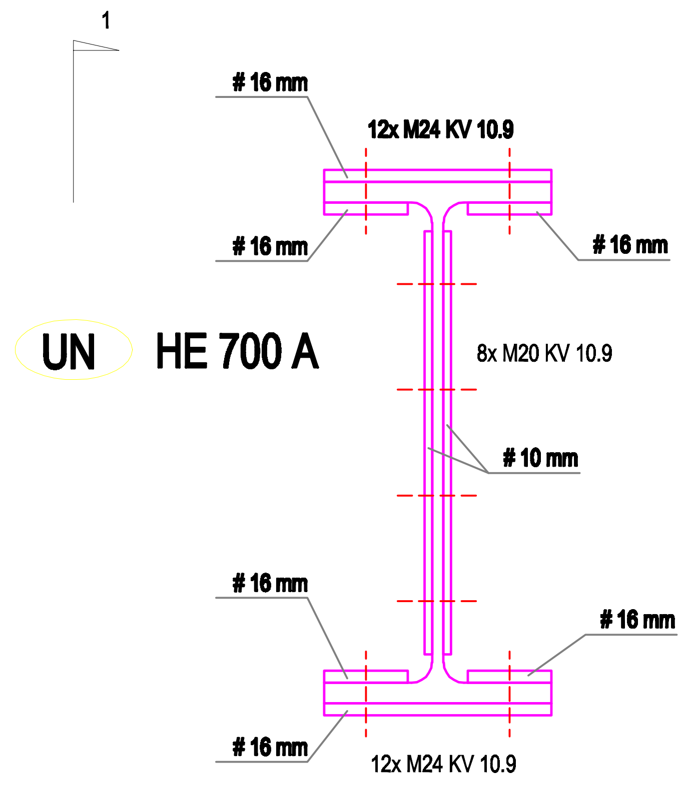
list **7.2.8.**

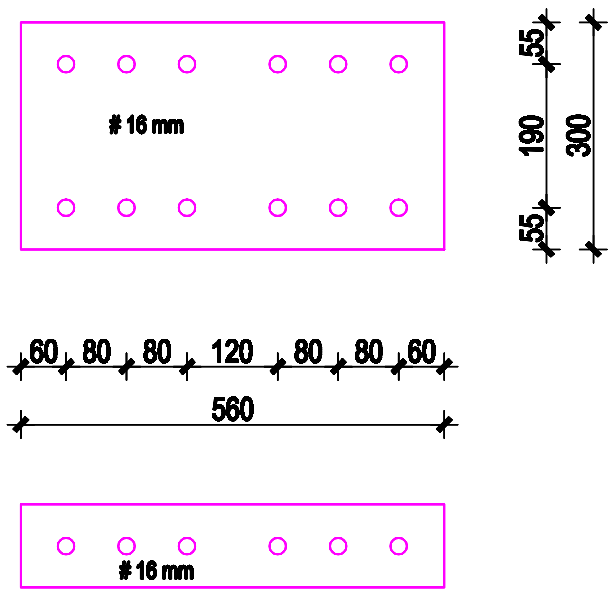
# MONTAŽNI NASTAVAK UZDUŽNOG NOSAČA POZICIJE UN

POGLED 1




POGLED 2




**Napomena:**
**Debljina vara u čvorovima rešetke se mijenja s obzirom na debljine stijenki cijevi u čvoru. Varove uvijek izvoditi sa debljinom t=0,7x(minimalna debljina stijenke u spoju)**

FAKULTET GRAĐEVINARSTVA, ARHITEKTURE I GEODEZIJE
KATEDRA ZA METALNE I DRVENE KONSTRUKCIJE
21000 SPLIT, MATICE HRVATSKE 15

SADRŽAJ LISTA:

## MONTAŽNI NASTAVAK UZDUŽNE GREDE POZICIJE UN

**M 1:10**

GRAĐEVINA:
**Pristanišna zgrada zračne luke Dubrovnik**
**Zgrada "ABC" - Sortirnica / Putnički terminal**

PROJEKT:
**Građenje južne nadstrešnice ispred zgrade "B" i zgrade "C"**

STUDENT:
**Mario Šarčević**

MENTOR:
**Prof.dr.sc. Bernardin Peroš**

FAZA PROJEKTA:
**IZVEDBENI PROJEKT**

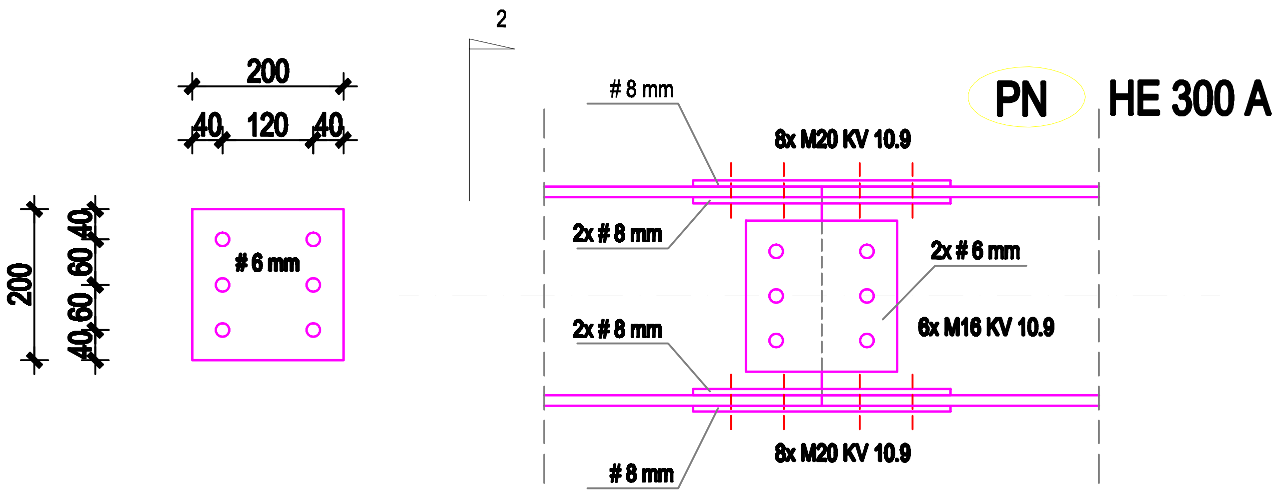
SADRŽAJ:
**7.2. GRAĐEVINSKI NACRTI: KONSTRUKCIJA JUŽNE NADSTREŠNICE**

DATUM:
lipanj, 2015. god.

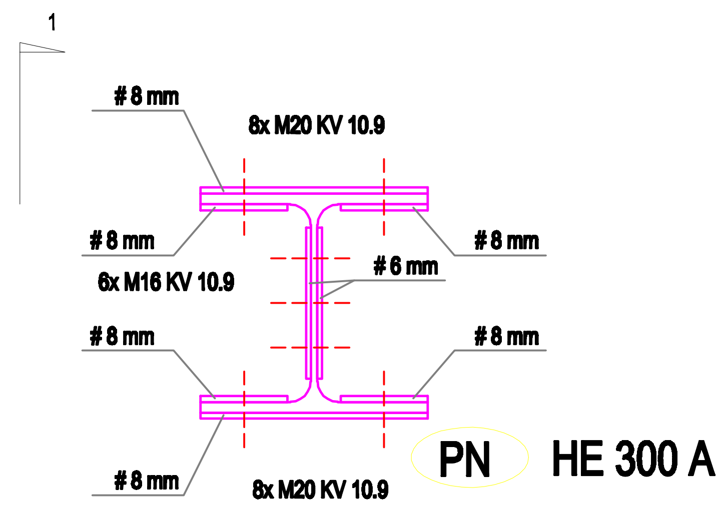
list **7.2.9.**

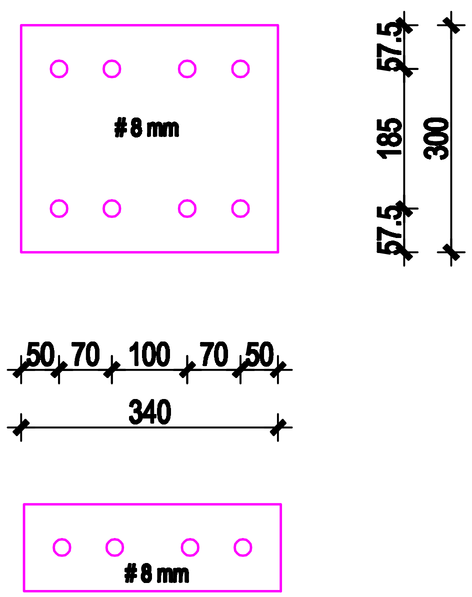
MONTAŽNI NASTAVAK POPREČNOG NOSAČA POZICIJE PN

POGLED 1




POGLED 2




**Napomena:**
Debljina vara u čvorovima rešetke se mijenja s obzirom na debljine stijenki cijevi u čvoru. Varove uvijek izvoditi sa debljinom t=0,7x(minimalna debljina stijenke u spoju)

FAKULTET GRAĐEVINARSTVA, ARHITEKTURE I GEODEZIJE
KATEDRA ZA METALNE I DRVENE KONSTRUKCIJE
21000 SPLIT, MATICE HRVATSKE 15

SADRŽAJ LISTA:

# MONTAŽNI NASTAVAK POPREČNE GREDE POZICIJE PN

M 1:10

GRAĐEVINA:
**Pristanišna zgrada zračne luke Dubrovnik**
**Zgrada "ABC" - Sortirnica / Putnički terminal**

PROJEKT:
**Građenje južne nadstrešnice ispred zgrade "B" i zgrade "C"**

STUDENT:
**Mario Šarčević**

MENTOR:
**Prof.dr.sc. Bernardin Peroš**

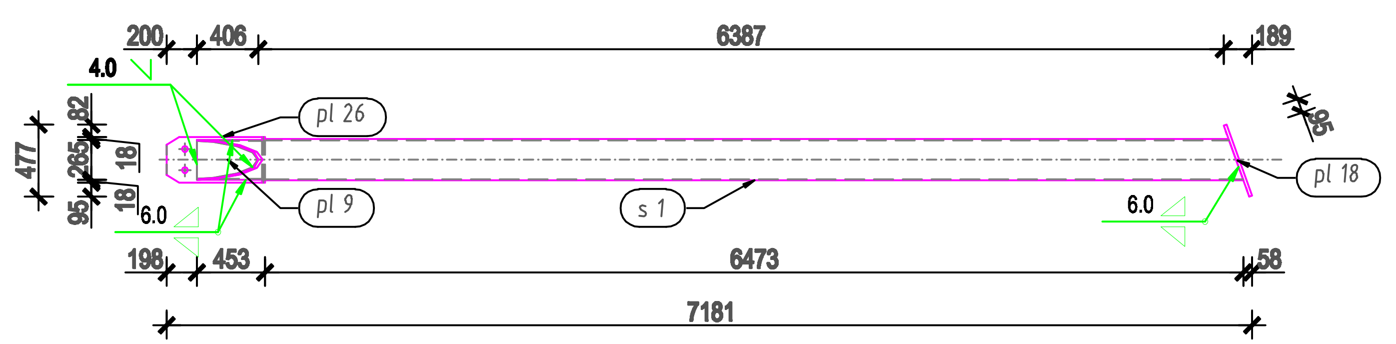
FAZA PROJEKTA:
**IZVEDBENI PROJEKT**

SADRŽAJ:
**7.2. GRAĐEVINSKI NACRTI: KONSTRUKCIJA JUŽNE NADSTREŠNICE**

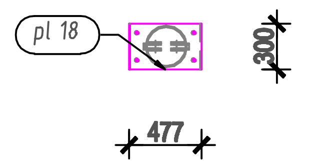
DATUM:
lipanj, 2015. god.

list **7.2.10.**

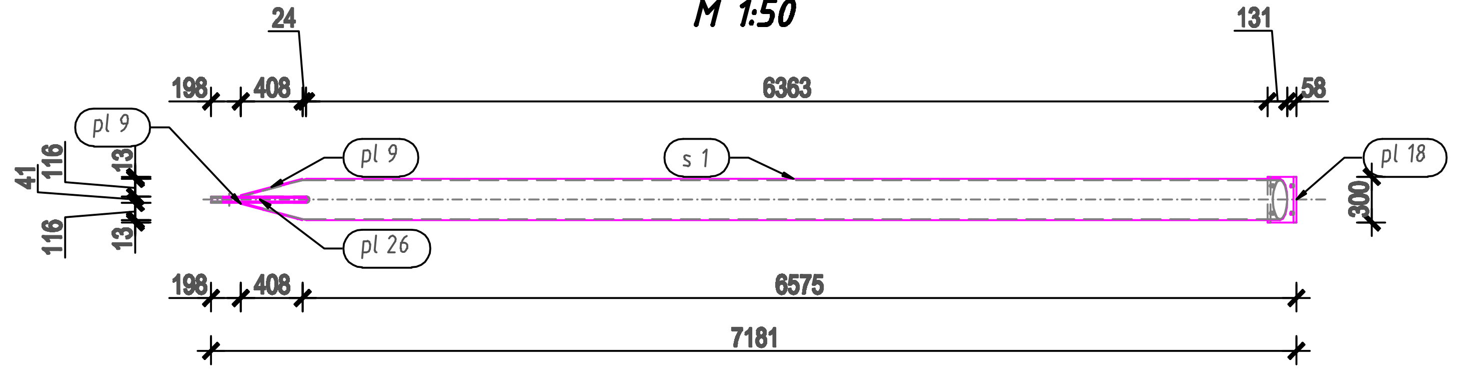
M 1:50



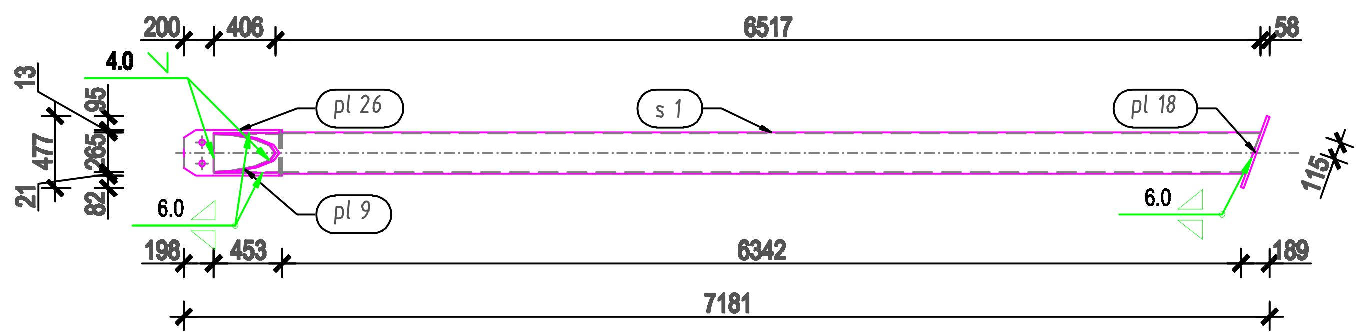
Pogled sa strane, 8 kom, S 2
M 1:50



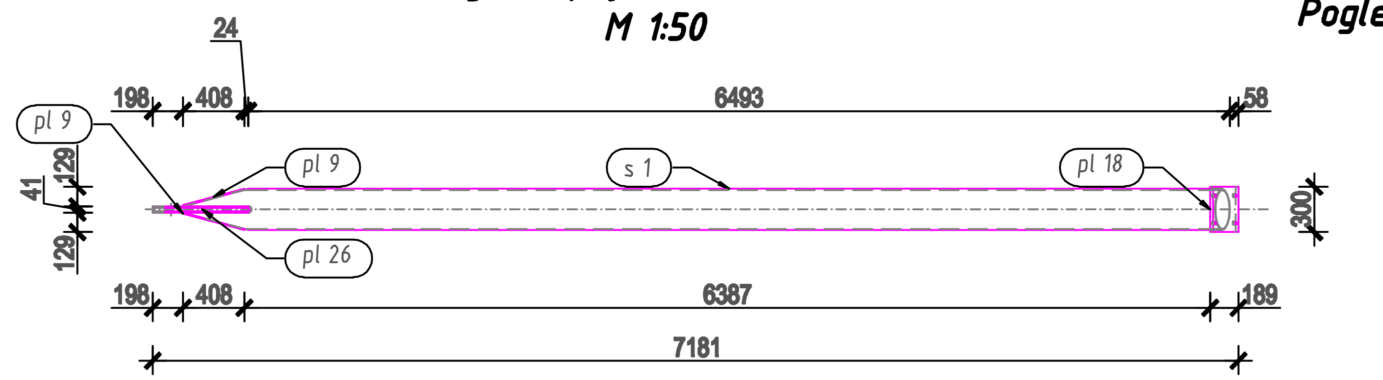
M 1:50



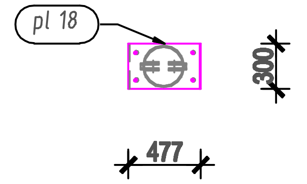
Pogled odozdo, 8 kom, S 2
M 1:50



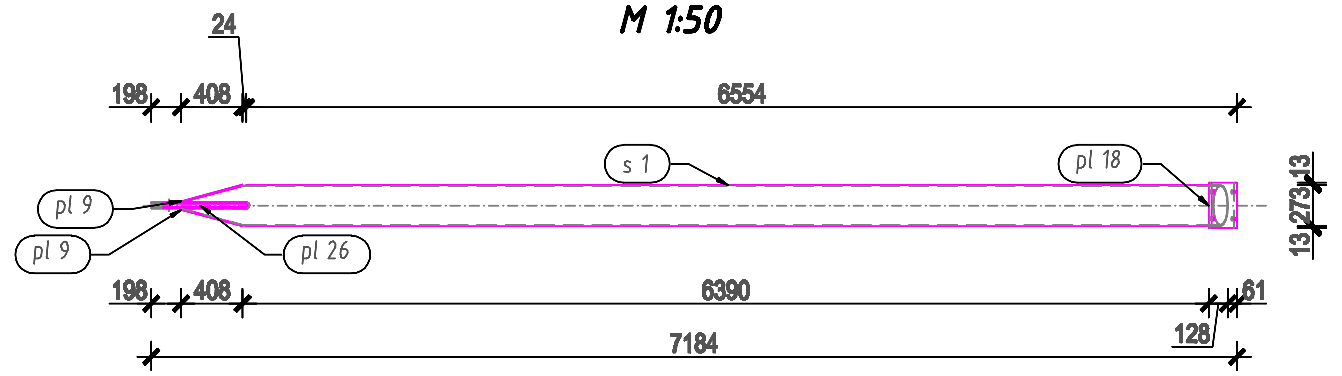
Pogled sprijeda, 8 kom, S 1
M 1:50



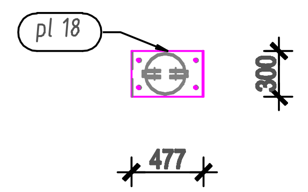
Pogled sa strane, 8 kom, S 1
M 1:50



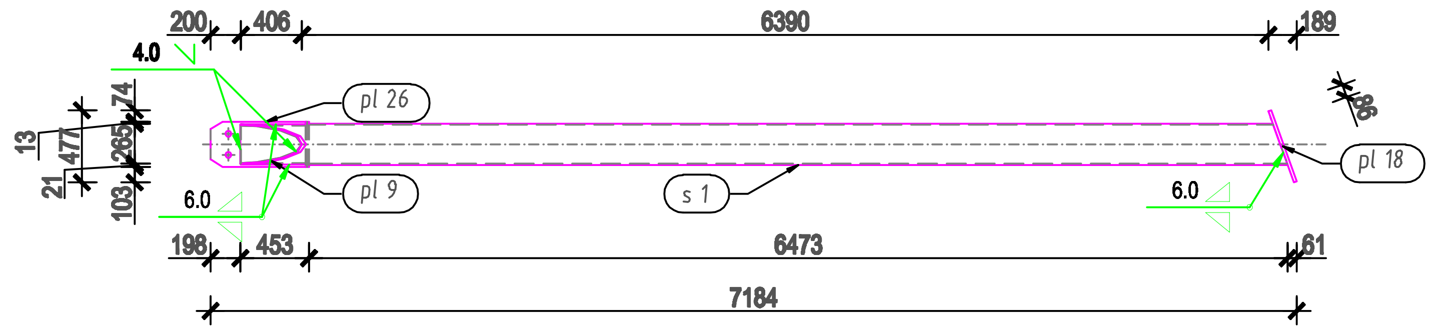
Pogled sprijeda, 8 kom, S 3
M 1:50



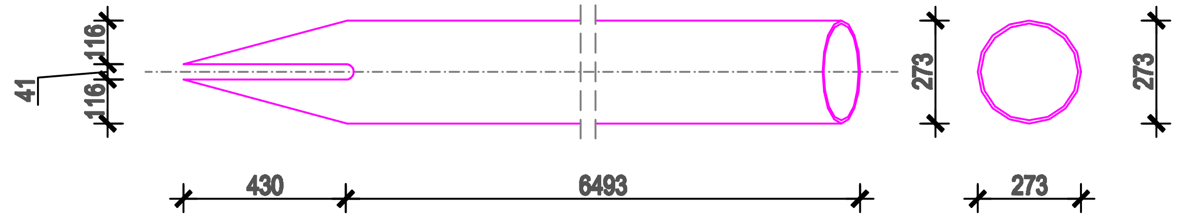
Pogled sa strane, 8 kom, S 3
M 1:50



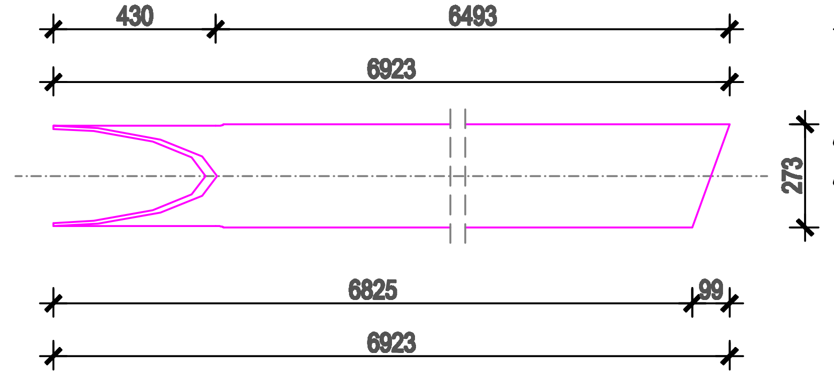
Pogled odozdo, 8 kom, S 3
M 1:50



Pogled sprijeda, 24 kom, s 1
M 1:20

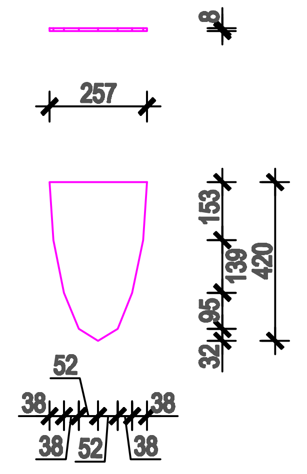


Pogled sa strane, 24 kom, s 1
M 1:20



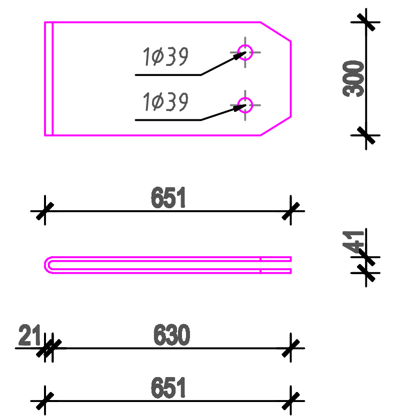
Pogled odozgo, 24 kom, s 1
M 1:20

Pogled sprijeda, 48 kom pl 9, Plate 8x420
M 1:20



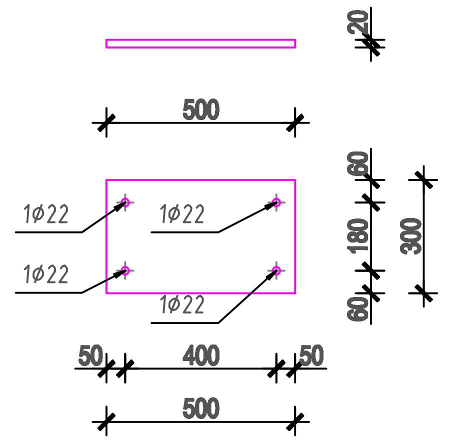
Pogled odozgo, 48 kom pl 9, Plate 8x420
M 1:20

Pogled sprijeda, 24 kom pl 26, Plate 300x41
M 1:20



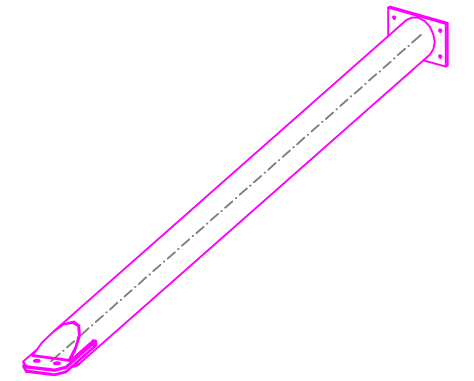
Pogled odozgo, 24 kom pl 26, Plate 300x41
M 1:20

Pogled sprijeda, 24 kom pl 18, Plate 20x300
M 1:20

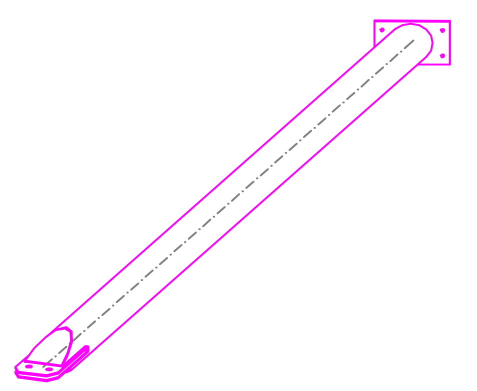


Pogled odozgo, 24 kom pl 18, Plate 20x300
M 1:20

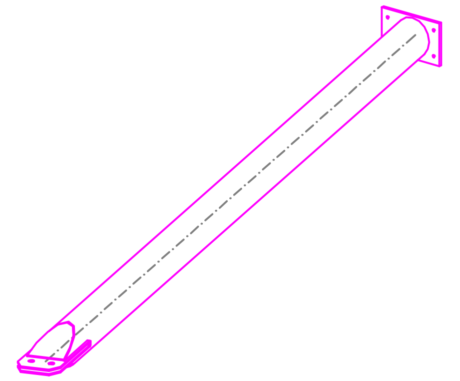
S 1 S CHS 273x8 3D 1:50



S 2 S CHS 273x8 3D 1:50



S 3 S CHS 273x8 3D 1:50



| | | | | | Unit (kg/m) | Total (kg) |
|---|---|---|---|---|---|---|
| Position=S 1 Number=8 Mass-Total=3404,93(kg) | | | | | | |
| pl 9 | Plate 8x420 | 2 | S 235 | 257,00 | | 10,34 |
| pl 18 | Plate 20x300 | 1 | S 235 | 500,00 | | 23,33 |
| pl 26 | Plate 300x41 | 1 | S 235 | 650,50 | | 29,86 |
| s 1 | CHS 273x8 | 1 | S 235 | 6923,31 | 52,300 | 362,09 |
| | | | | | | 425,62 |

**PROTUPOŽARNA I ANTIKOROZIVNA ZAŠTITA: PREMAZIVANJE**

ZAHTJEV TRAJNOSTI ANTIKOROZIVNE ZAŠTITE: HIGH DURABILITY ( prema HRN EN ISO 12944-1:1998)

AGRESIVNOST SREDINE: C1 - LOW (prema tablici 1 iz HRN EN ISO 12944-2:1998)

ZAHTJEV PROTUPOŽARNE OTPORNOSTI:

SADRŽAJ LISTA:

# STUPOVI - POZ S1, S2 I S3

M 1:20 1:10

FAKULTET GRAĐEVINARSTVA, ARHITEKTURE I GEODEZIJE
KATEDRA ZA METALNE I DRVENE KONSTRUKCIJE
21000 SPLIT, MATICE HRVATSKE 15

GRAĐEVINA:
**Pristanišna zgrada zračne luke Dubrovnik Zgrada "ABC" - Sortirnica / Putnički terminal**

PROJEKT:
**Građenje južne nadstrešnice ispred zgrade "B" i zgrade "C"**

STUDENT:
**Mario Šarčević**

MENTOR:
**Prof.dr.sc. Bernardin Peroš**

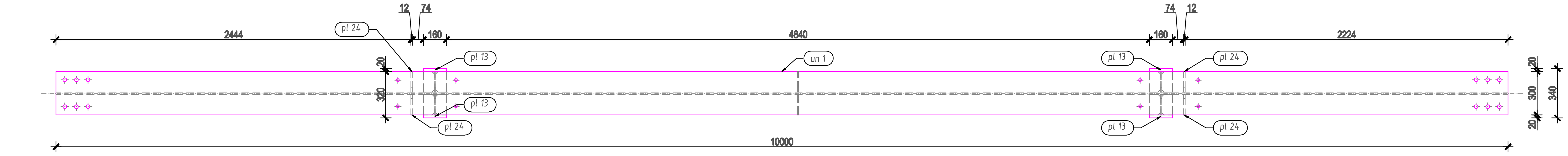
FAZA PROJEKTA:
**IZVEDBENI PROJEKT**

SADRŽAJ:
**7.2. GRAĐEVINSKI NACRTI: KONSTRUKCIJA JUŽNE NADSTREŠNICE**

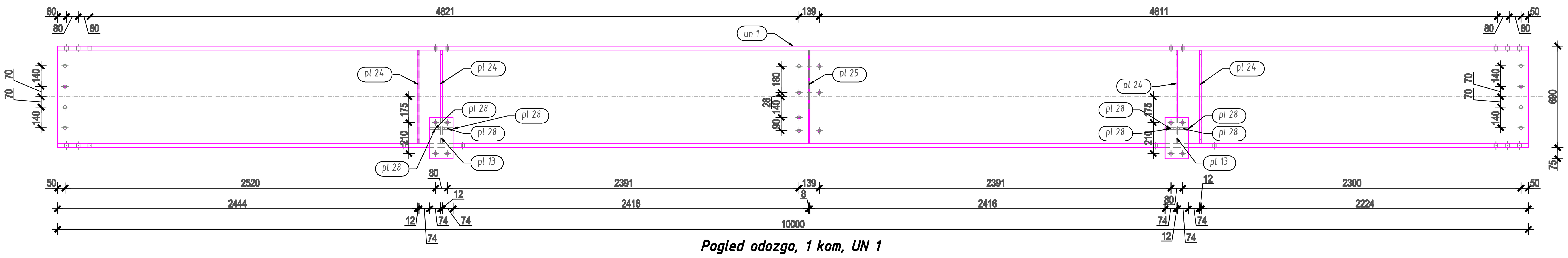
DATUM:
lipanj, 2015. god.

list **7.2.11.**

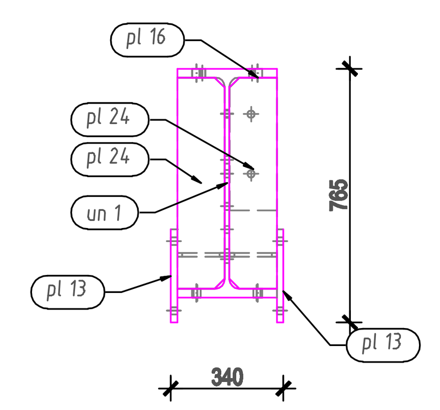
Pogled odozdo, 1 kom, UN 1
M 1:20



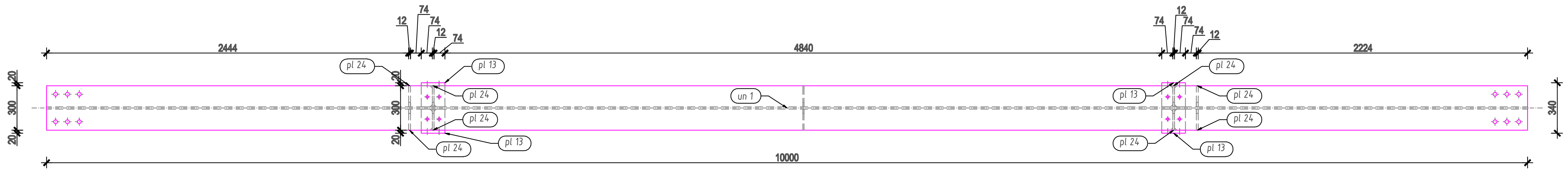
Pogled sprijeda, 1 kom, UN 1
M 1:20

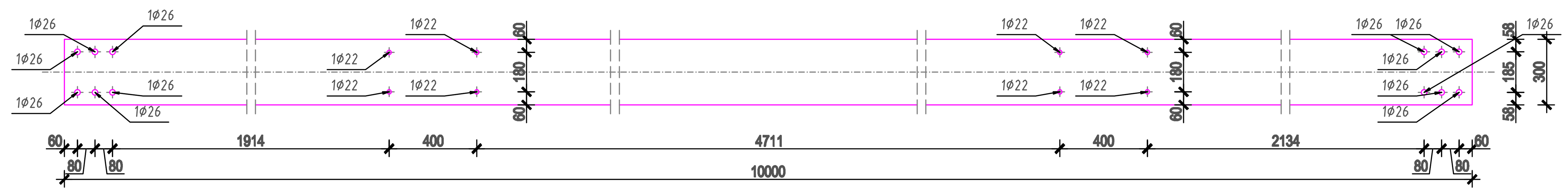


Pogled sa strane, 1 kom, UN 1
M 1:20



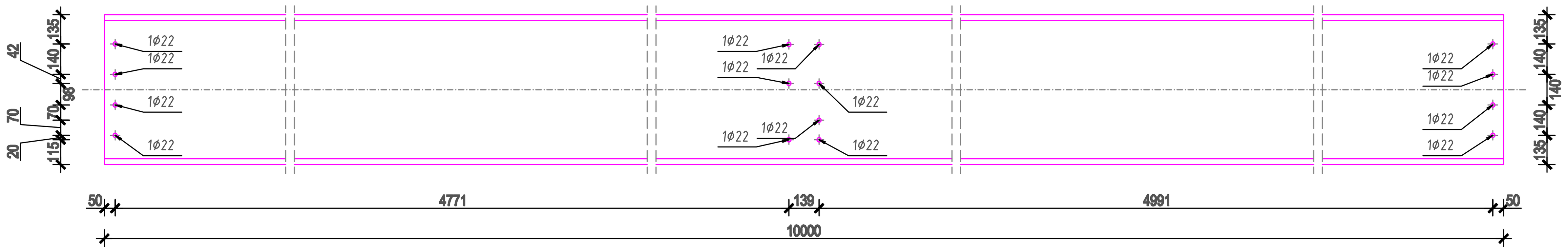
Pogled odozgo, 1 kom, UN 1
M 1:20

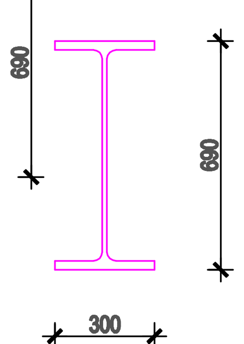




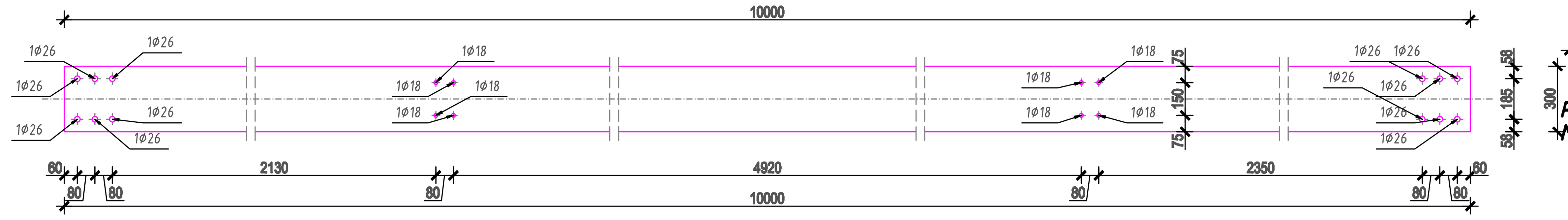
Pogled odozdo, 4 kom, un 1
M 1:20

Pogled sprijeda, 4 kom, un 1
M 1:20



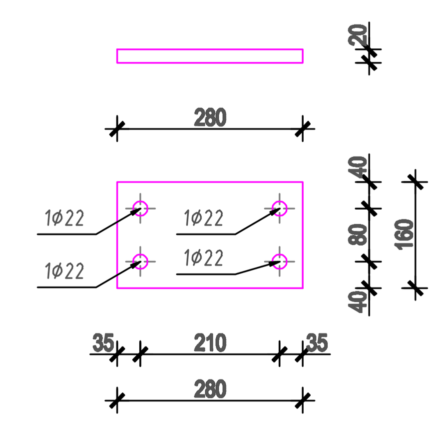


Pogled sa strane, 4 kom, un 1
M 1:20



Pogled odozgo, 4 kom, un 1
M 1:20

Pogled sprijeda, 136 kom pl 13, Plate 20x160
M 1:10



Pogled odozgo, 136 kom pl 13, Plate 20x160
M 1:10

| Position | Section | Number | Grade | Length (mm) | Mass | |
|---|---|---|---|---|---|---|
| | | | | | Unit (kg/m) | Total (kg) |
| Position=UN 1 Number=1 Mass-Total=2156,65(kg) | | | | | | |
| pl 13 | Plate 20x160 | 4 | S 235 | 280,00 | | 27,21 |
| pl 16 | Plate 8x143 | 1 | S 235 | 400,00 | | 3,51 |
| pl 24 | Plate 12x143 | 8 | S 235 | 636,00 | | 67,76 |
| pl 25 | Plate 8x143 | 1 | S 235 | 636,00 | | 5,64 |
| pl 28 | Plate 12x74 | 8 | S 235 | 142,50 | | 7,78 |
| un 1 | HEA 700 | 1 | S 235 | 10000,00 | 204,475 | 2044,75 |
| | | | | | | 2156,65 |

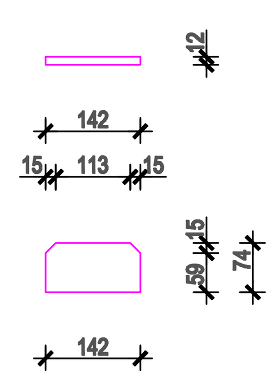
**PROTUPOŽARNA I ANTIKOROZIVNA ZAŠTITA: PREMAZIVANJE**

ZAHTJEV TRAJNOSTI ANTIKOROZIVNE ZAŠTITE: HIGH DURABILITY (prema HRN EN ISO 12944-1:1998)

AGRESIVNOST SREDINE: C1 - LOW (prema tablici 1 iz HRN EN ISO 12944-2:1998)

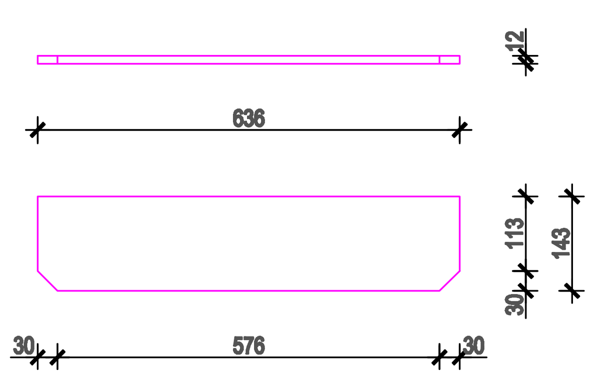
ZAHTJEV PROTUPOŽARNE OTPORNOSTI:

Pogled sprijeda, 16 kom pl 28, Plate 12x74
M 1:10



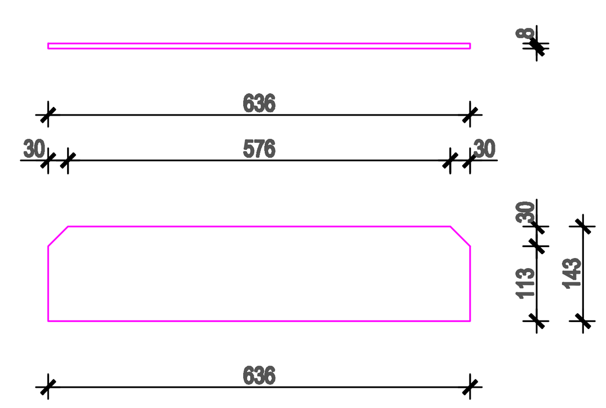
Pogled odozgo, 16 kom pl 28, Plate 12x74
M 1:10

Pogled sprijeda, 100 kom pl 24, Plate 12x143
M 1:10



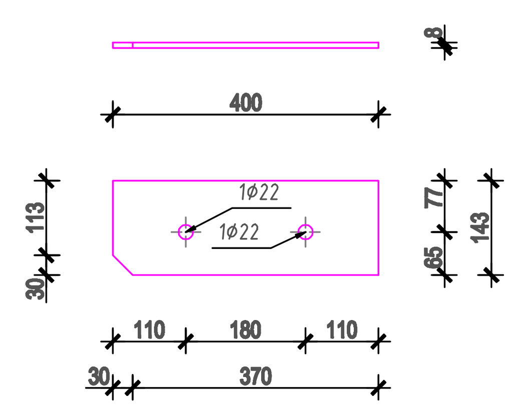
Pogled odozgo, 100 kom pl 24, Plate 12x143
M 1:10

Pogled sprijeda, 8 kom pl 25, Plate 8x143
M 1:10



Pogled odozgo, 8 kom pl 25, Plate 8x143
M 1:10

Pogled sprijeda, 8 kom pl 16, Plate 8x143
M 1:10



Pogled odozgo, 8 kom pl 16, Plate 8x143
M 1:10


FAKULTET GRAĐEVINARSTVA, ARHITEKTURE I GEODEZIJE
KATEDRA ZA METALNE I DRVENE KONSTRUKCIJE
21000 SPLIT, MATICE HRVATSKE 15


SADRŽAJ LISTA:

# UZDUŽNI NOSAČ - POZ UN1

M 1:20 1:10

GRAĐEVINA:
**Pristanišna zgrada zračne luke Dubrovnik Zgrada "ABC" - Sortirnica / Putnički terminal**

PROJEKT:
**Građenje južne nadstrešnice ispred zgrade "B" i zgrade "C"**


STUDENT:
**Mario Šarčević**

MENTOR:
**Prof.dr.sc. Bernardin Peroš**


FAZA PROJEKTA:
**IZVEDBENI PROJEKT**

SADRŽAJ:
**7.2. GRAĐEVINSKI NACRTI: KONSTRUKCIJA JUŽNE NADSTREŠNICE**

DATUM:
lipanj, 2015. god.


| | | | | | Unit (kg/m) | Total (kg) |
|---|---|---|---|---|---|---|
| Position=PN 1 Number=8 Mass-Total=4333,74(kg) | | | | | | |
| pl 10 | Plate 10x146 | 4 | S 235 | 262,00 | | 11,71 |
| pn 1 | HEA 300 | 1 | S 235 | 6000,00 | 88,334 | 530,01 |
| | | | | | | 541,72 |
| Position | Section | Number | Grade | Length (mm) | Mass | |
| | | | | | Unit (kg/m) | Total (kg) |
| Position=PN 2 Number=4 Mass-Total=2522,83(kg) | | | | | | |
| pn 2 | HEA 300 | 1 | S 235 | 7140,00 | 88,334 | 630,71 |
| | | | | | | 630,71 |

***PROTUPOŽARNA I ANTIKOROZIVNA ZAŠTITA: PREMAZIVANJE***

ZAHTJEV TRAJNOSTI ANTIKOROZIVNE ZAŠTITE: HIGH DURABILITY ( prema HRN EN ISO 12944-1:1998)

AGRESIVNOST SREDINE: C1 - LOW (prema tablici 1 iz HRN EN ISO 12944-2:1998)

ZAHTJEV PROTUPOŽARNE OTPORNOSTI:

FAKULTET GRAĐEVINARSTVA, ARHITEKTURE I GEODEZIJE
KATEDRA ZA METALNE I DRVENE KONSTRUKCIJE
21000 SPLIT, MATICE HRVATSKE 15

SADRŽAJ LISTA:

# POPREČNI NOSAČ - POZ PN1 I PN2

M 1:20 1:10

GRAĐEVINA:
**Pristanišna zgrada zračne luke Dubrovnik**
**Zgrada "ABC" - Sortirnica / Putnički terminal**

PROJEKT:
**Građenje južne nadstrešnice ispred zgrade "B" i zgrade "C"**

STUDENT:
**Mario Šarčević**

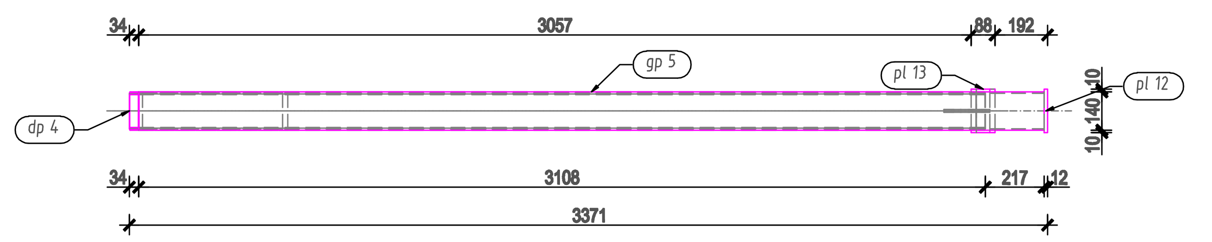
MENTOR:
**Prof.dr.sc. Bernardin Peroš**

FAZA PROJEKTA:
**IZVEDBENI PROJEKT**

SADRŽAJ:
**7.2. GRAĐEVINSKI NACRTI: KONSTRUKCIJA JUŽNE NADSTREŠNICE**

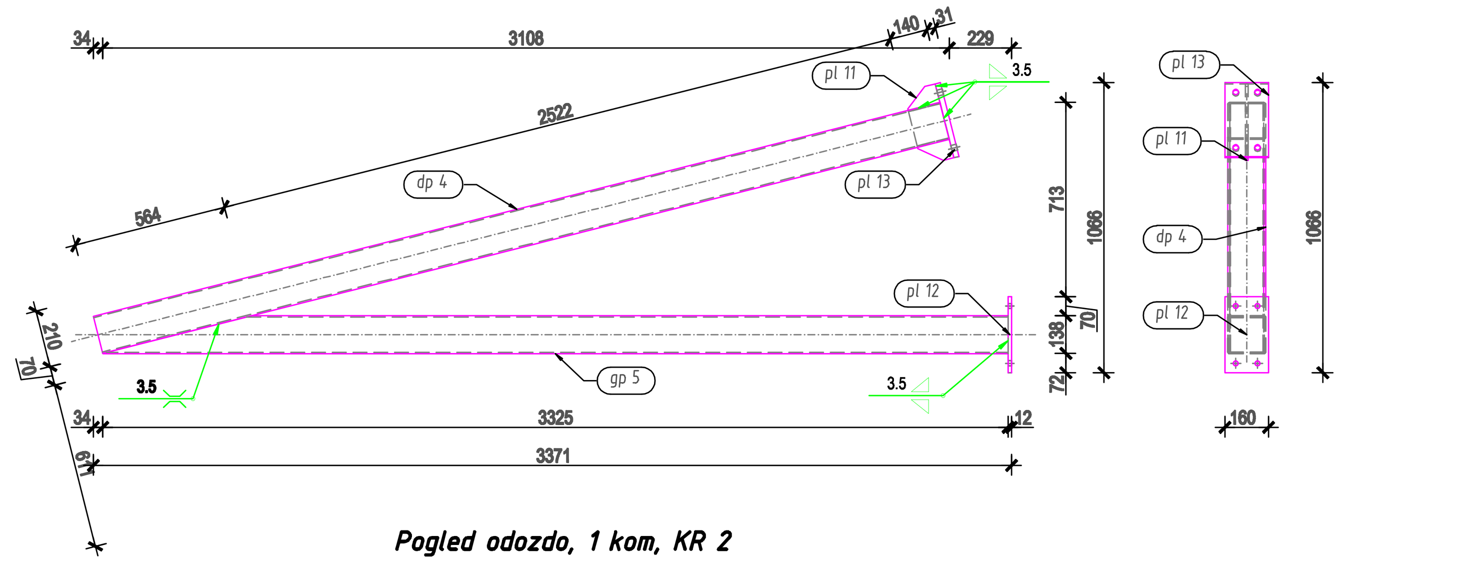
DATUM:
lipanj, 2015. god.

M 1:20

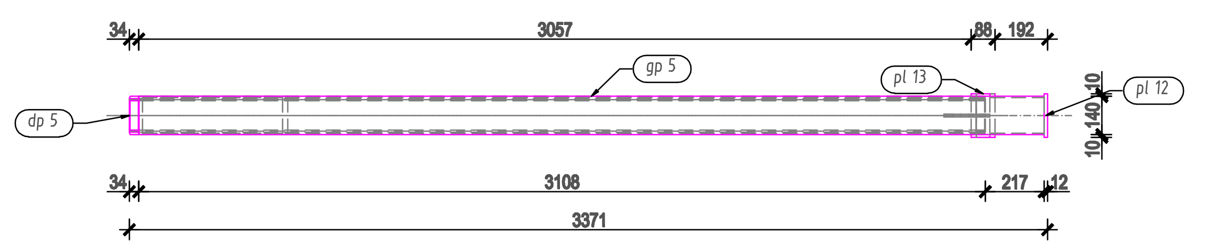


Pogled sprijeda, 1 kom, KR 1
M 1:20

Pogled sa strane, 1 kom, KR 1
M 1:20

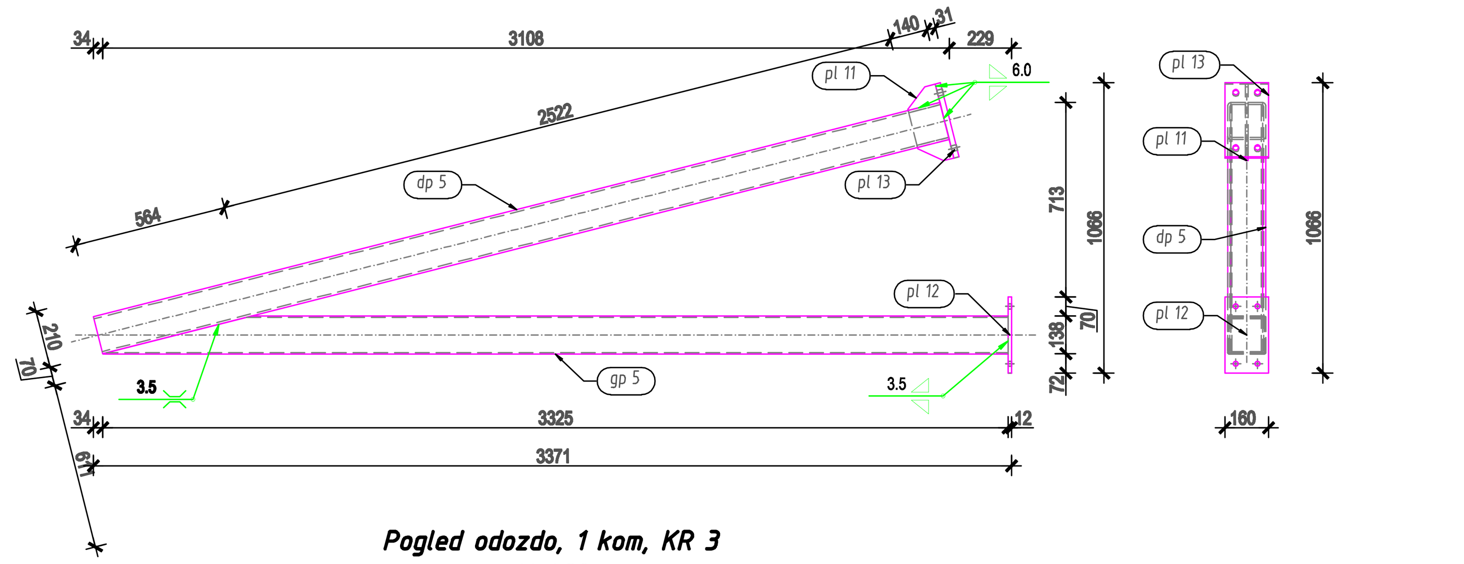


Pogled odozdo, 1 kom, KR 2
M 1:20

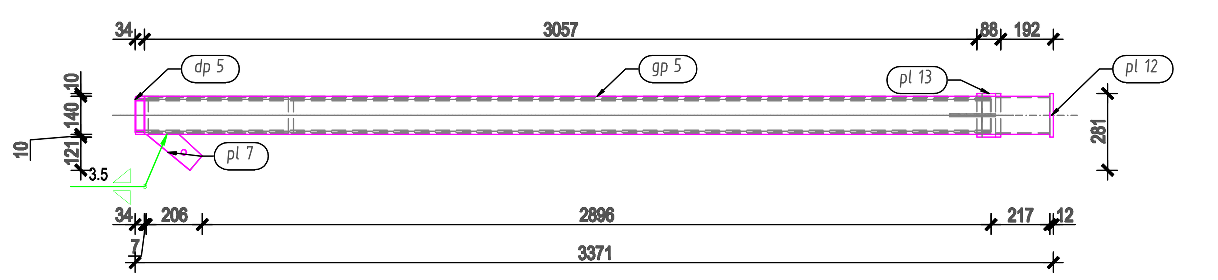


Pogled sprijeda, 1 kom, KR 2
M 1:20

Pogled sa strane, 1 kom, KR 2
M 1:20

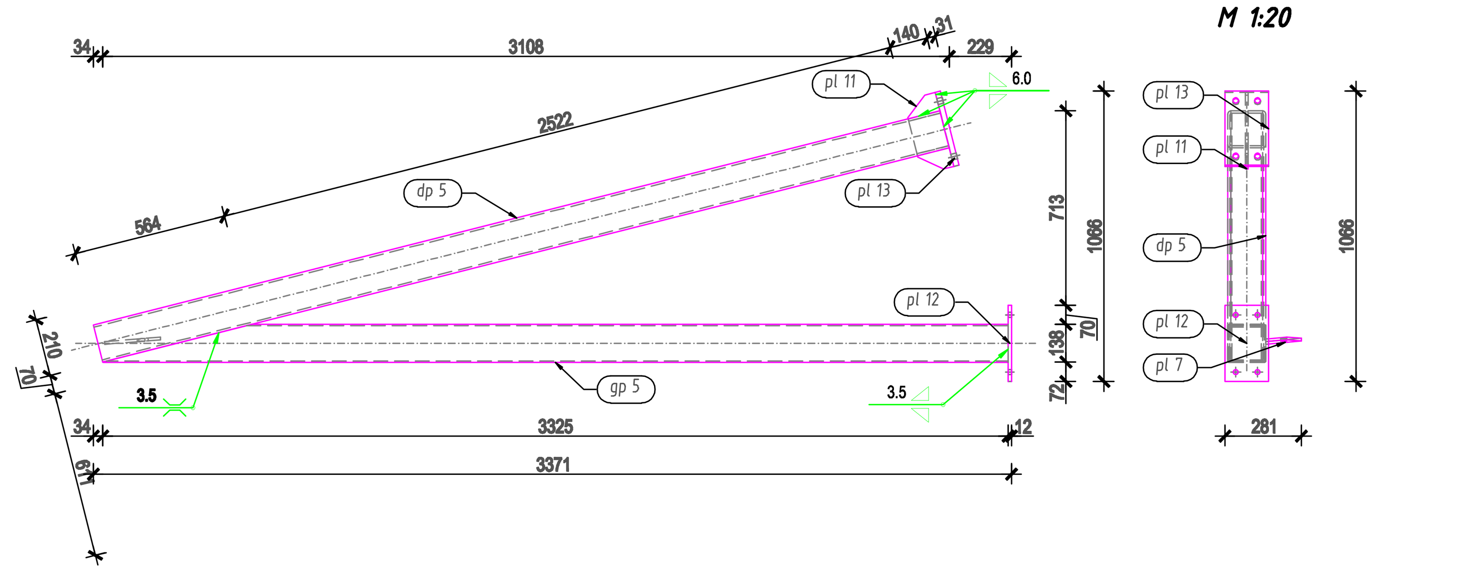


Pogled odozdo, 1 kom, KR 3
M 1:20

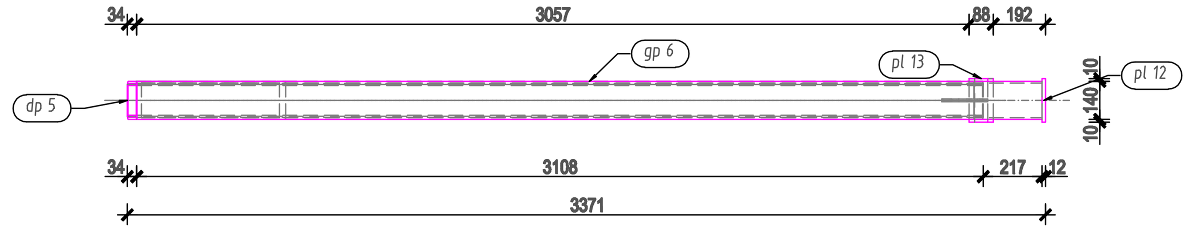


Pogled sprijeda, 1 kom, KR 3
M 1:20

Pogled sa strane, 1 kom, KR 3
M 1:20

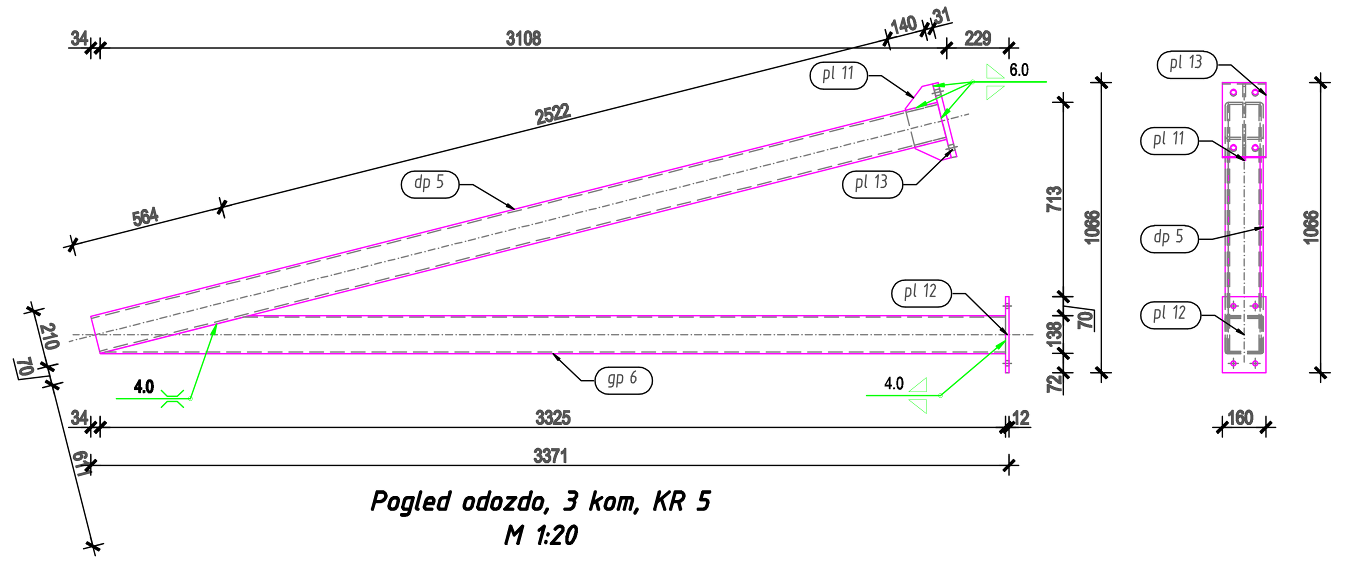


M 1:20

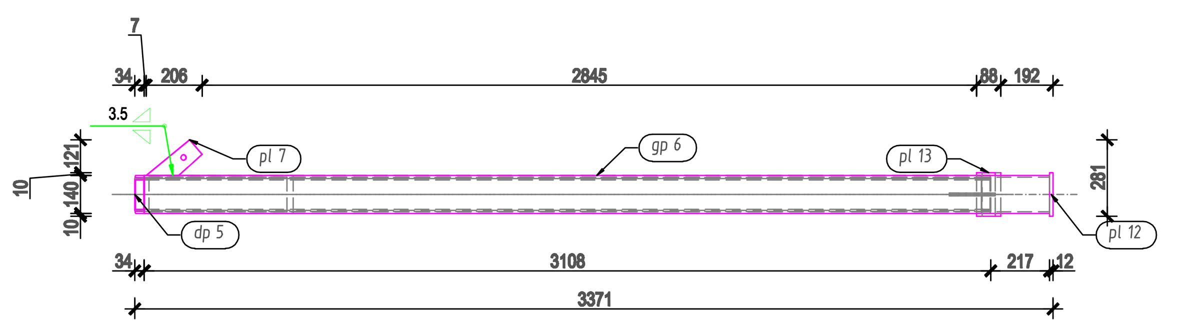


Pogled sprijeda, 5 kom, KR 4
M 1:20

Pogled sa strane, 5 kom, KR 4
M 1:20

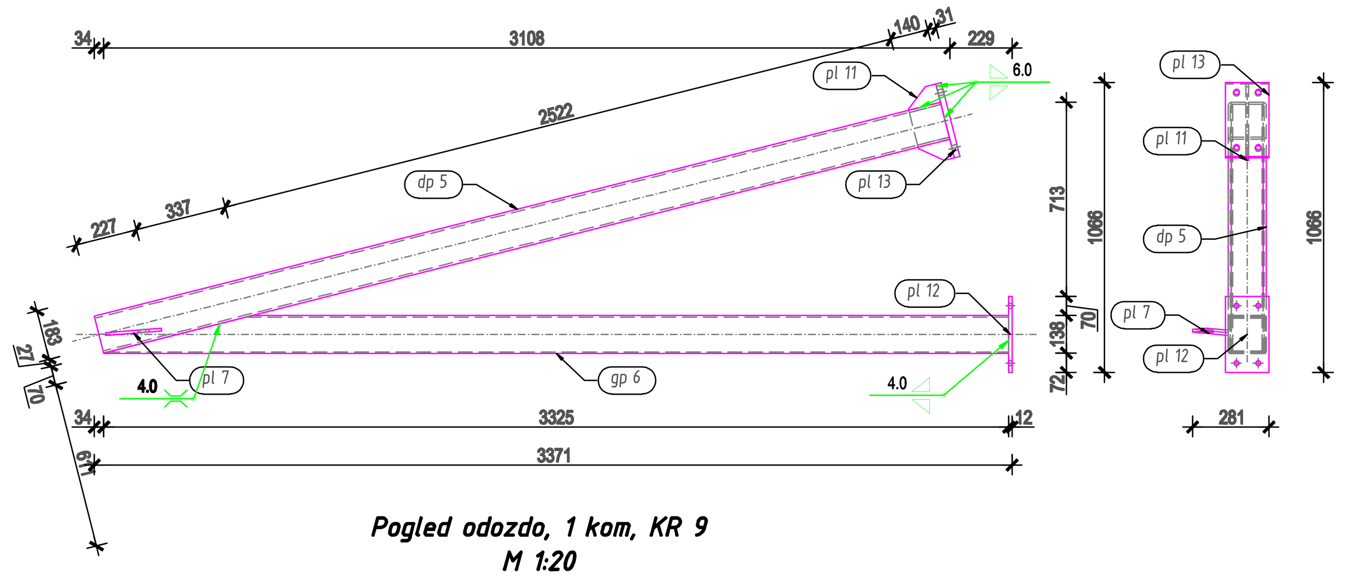


Pogled odozdo, 3 kom, KR 5
M 1:20

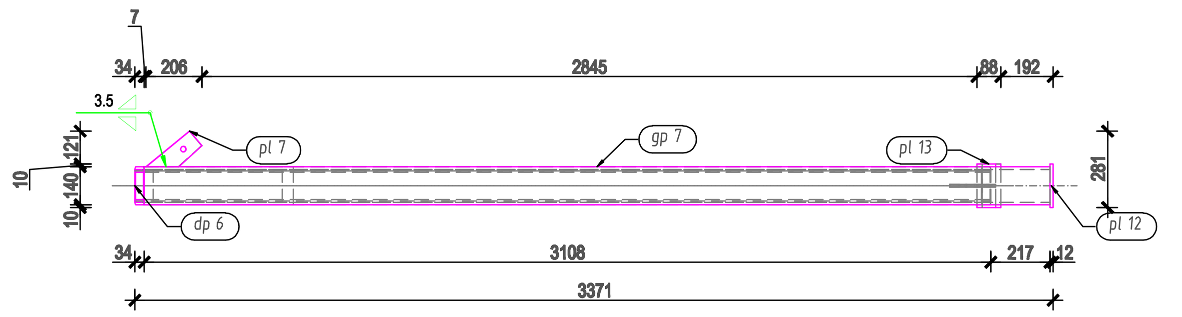


Pogled sprijeda, 3 kom, KR 5
M 1:20

Pogled sa strane, 3 kom, KR 5
M 1:20

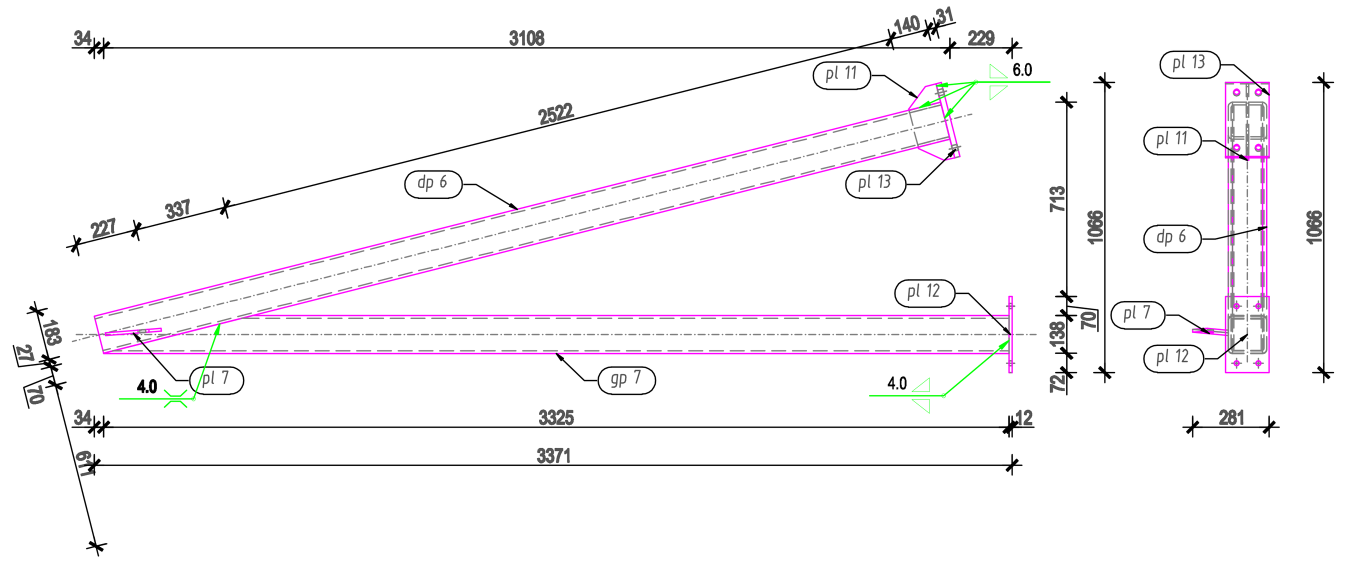


Pogled odozdo, 1 kom, KR 9
M 1:20

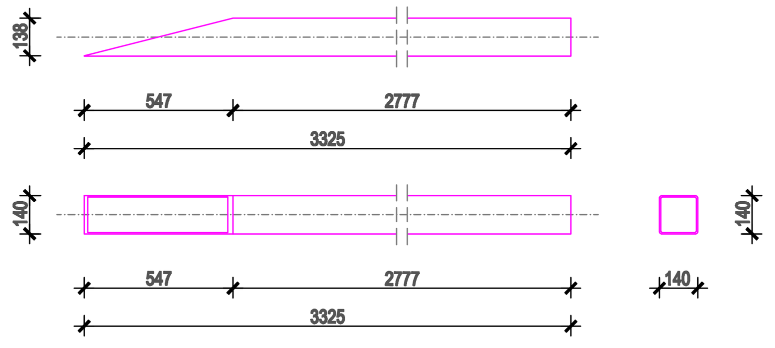


Pogled sprijeda, 1 kom, KR 9
M 1:20

Pogled sa strane, 1 kom, KR 9
M 1:20



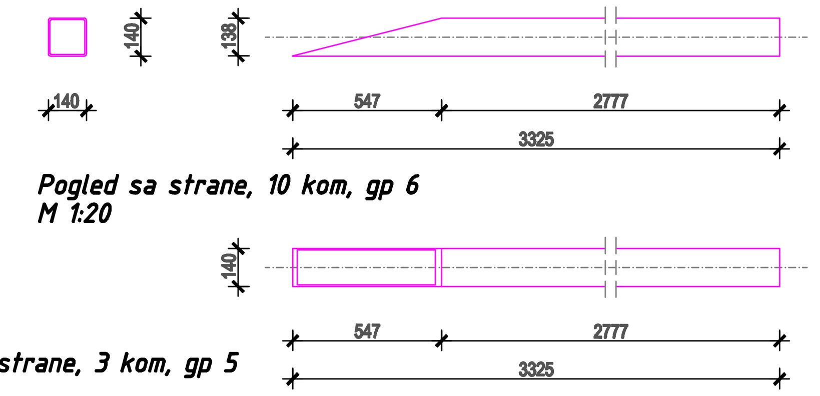
Pogled sprijeda, 3 kom, gp 5
M 1:20



Pogled odozdo, 3 kom, gp 5
M 1:20

Pogled sa strane, 3 kom, gp 5
M 1:20

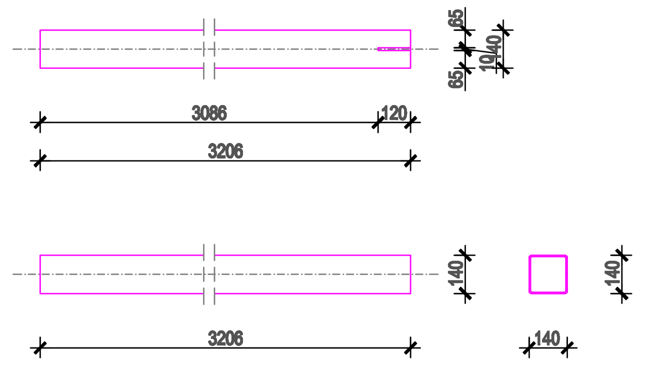
Pogled sprijeda, 10 kom, gp 6
M 1:20



Pogled sa strane, 10 kom, gp 6
M 1:20

Pogled odozdo, 10 kom, gp 6
M 1:20

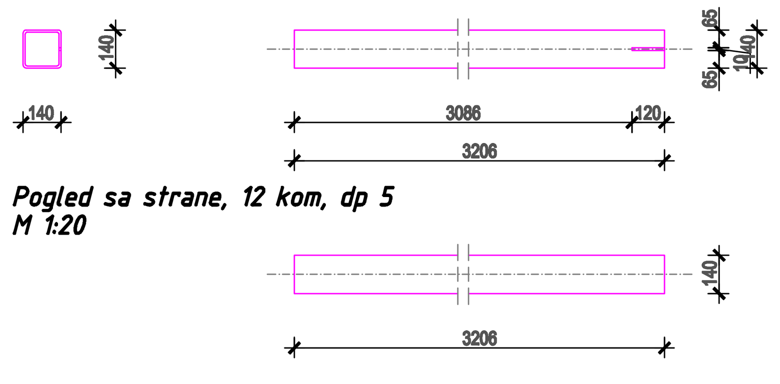
Pogled sprijeda, 1 kom, dp 4
M 1:20



Pogled odozdo, 1 kom, dp 4
M 1:20

Pogled sa strane, 1 kom, dp 4
M 1:20

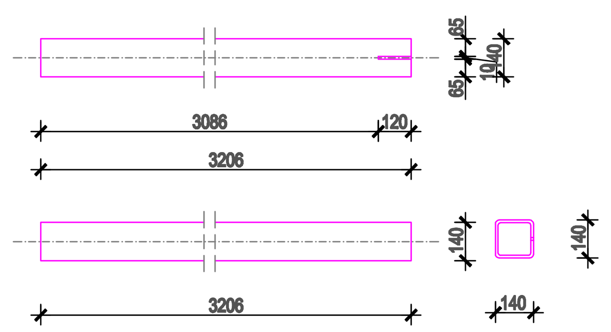
Pogled sprijeda, 12 kom, dp 5
M 1:20



Pogled sa strane, 12 kom, dp 5
M 1:20

Pogled odozdo, 12 kom, dp 5
M 1:20

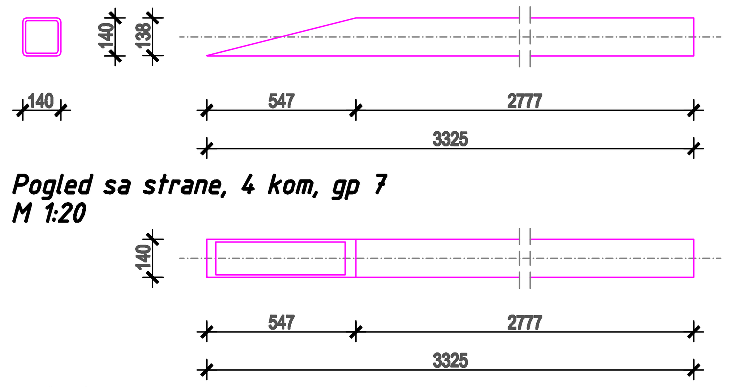
Pogled sprijeda, 4 kom, dp 6
M 1:20



Pogled odozdo, 4 kom, dp 6
M 1:20

Pogled sa strane, 4 kom, dp 6
M 1:20

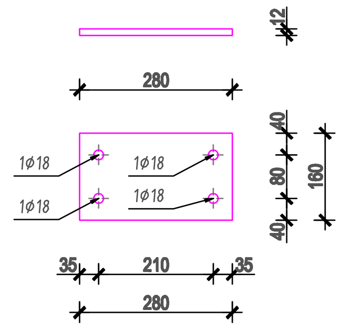
Pogled sprijeda, 4 kom, gp 7
M 1:20



Pogled sa strane, 4 kom, gp 7
M 1:20

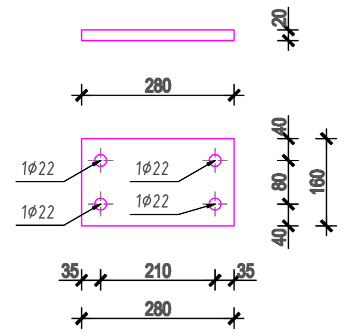
Pogled odozdo, 4 kom, gp 7
M 1:20

Pogled sprijeda, 34 kom pl 12, Plate 12x160
M 1:10



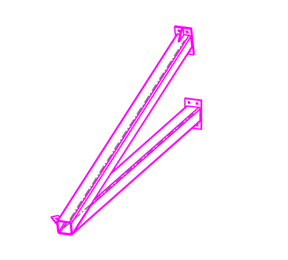
Pogled odozdo, 34 kom pl 12, Plate 12x160
M 1:10

Pogled sprijeda, 136 kom pl 13, Plate 20x160
M 1:10

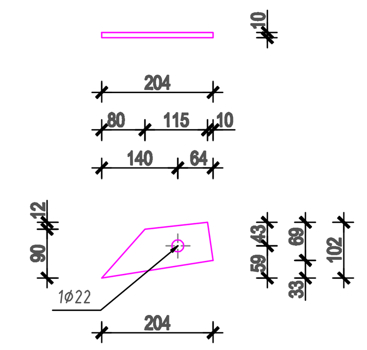


Pogled odozdo, 136 kom pl 13, Plate 20x160
M 1:10

KR Q 140x140x10 3D 1:50

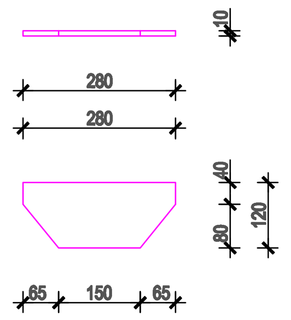


Pogled sprijeda, 16 kom pl 7, Plate 10x102
M 1:10



Pogled odozdo, 16 kom pl 7, Plate 10x102
M 1:10

Pogled sprijeda, 68 kom pl 11, Plate 10x120
M 1:10



Pogled odozdo, 68 kom pl 11, Plate 10x120
M 1:10

| | | | | | Unit (kg/m) | Total (kg) |
|---|---|---|---|---|---|---|
| Position=KR 1 Number=1 Mass-Total=151,01(kg) | | | | | | |
| dp 4 | Q 140x140x5 | 1 | S 235 | 3205,94 | 21,108 | 67,67 |
| gp 5 | Q 140x140x5 | 1 | S 235 | 3324,65 | 21,108 | 70,18 |
| pl 11 | Plate 10x120 | 1 | S 235 | 280,00 | | 2,23 |
| pl 12 | Plate 12x160 | 1 | S 235 | 280,00 | | 4,13 |
| pl 13 | Plate 20x160 | 1 | S 235 | 280,00 | | 6,80 |
| | | | | | | 151,01 |
| Position=KR 2 Number=1 Mass-Total=185,99(kg) | | | | | | |
| dp 5 | Q 140x140x8 | 1 | S 235 | 3205,94 | 32,019 | 102,65 |
| gp 5 | Q 140x140x5 | 1 | S 235 | 3324,65 | 21,108 | 70,18 |
| pl 11 | Plate 10x120 | 1 | S 235 | 280,00 | | 2,23 |
| pl 12 | Plate 12x160 | 1 | S 235 | 280,00 | | 4,13 |
| pl 13 | Plate 20x160 | 1 | S 235 | 280,00 | | 6,80 |
| | | | | | | 185,99 |
| Position=KR 3 Number=1 Mass-Total=186,90(kg) | | | | | | |
| dp 5 | Q 140x140x8 | 1 | S 235 | 3205,94 | 32,019 | 102,65 |
| gp 5 | Q 140x140x5 | 1 | S 235 | 3324,65 | 21,108 | 70,18 |
| pl 7 | Plate 10x102 | 1 | S 235 | 204,37 | | 0,91 |
| pl 11 | Plate 10x120 | 1 | S 235 | 280,00 | | 2,23 |
| pl 12 | Plate 12x160 | 1 | S 235 | 280,00 | | 4,13 |
| pl 13 | Plate 20x160 | 1 | S 235 | 280,00 | | 6,80 |
| | | | | | | 186,90 |
| Position=KR 4 Number=5 Mass-Total=994,36(kg) | | | | | | |
| dp 5 | Q 140x140x8 | 1 | S 235 | 3205,94 | 32,019 | 102,65 |
| gp 6 | Q 140x140x6 | 1 | S 235 | 3324,65 | 24,983 | 83,06 |
| pl 11 | Plate 10x120 | 1 | S 235 | 280,00 | | 2,23 |
| pl 12 | Plate 12x160 | 1 | S 235 | 280,00 | | 4,13 |
| pl 13 | Plate 20x160 | 1 | S 235 | 280,00 | | 6,80 |
| | | | | | | 198,87 |
| Position=KR 5 Number=3 Mass-Total=599,34(kg) | | | | | | |
| dp 5 | Q 140x140x8 | 1 | S 235 | 3205,94 | 32,019 | 102,65 |
| gp 6 | Q 140x140x6 | 1 | S 235 | 3324,65 | 24,983 | 83,06 |
| pl 7 | Plate 10x102 | 1 | S 235 | 204,37 | | 0,91 |
| pl 11 | Plate 10x120 | 1 | S 235 | 280,00 | | 2,23 |
| pl 12 | Plate 12x160 | 1 | S 235 | 280,00 | | 4,13 |
| pl 13 | Plate 20x160 | 1 | S 235 | 280,00 | | 6,80 |
| | | | | | | 199,78 |
| Position=KR 6 Number=2 Mass-Total=399,56(kg) | | | | | | |
| dp 5 | Q 140x140x8 | 1 | S 235 | 3205,94 | 32,019 | 102,65 |
| gp 6 | Q 140x140x6 | 1 | S 235 | 3324,65 | 24,983 | 83,06 |
| pl 7 | Plate 10x102 | 1 | S 235 | 204,37 | | 0,91 |
| pl 11 | Plate 10x120 | 1 | S 235 | 280,00 | | 2,23 |
| pl 12 | Plate 12x160 | 1 | S 235 | 280,00 | | 4,13 |
| pl 13 | Plate 20x160 | 1 | S 235 | 280,00 | | 6,80 |
| | | | | | | 199,78 |
| Position=KR 7 Number=2 Mass-Total=533,77(kg) | | | | | | |
| dp 6 | Q 140x140x10 | 1 | S 235 | 3205,94 | 38,851 | 124,55 |
| gp 7 | Q 140x140x10 | 1 | S 235 | 3324,65 | 38,851 | 129,17 |
| pl 11 | Plate 10x120 | 1 | S 235 | 280,00 | | 2,23 |
| pl 12 | Plate 12x160 | 1 | S 235 | 280,00 | | 4,13 |
| pl 13 | Plate 20x160 | 1 | S 235 | 280,00 | | 6,80 |
| | | | | | | 266,88 |
| Position=KR 8 Number=1 Mass-Total=267,79(kg) | | | | | | |
| dp 6 | Q 140x140x10 | 1 | S 235 | 3205,94 | 38,851 | 124,55 |
| gp 7 | Q 140x140x10 | 1 | S 235 | 3324,65 | 38,851 | 129,17 |
| pl 7 | Plate 10x102 | 1 | S 235 | 204,37 | | 0,91 |
| pl 11 | Plate 10x120 | 1 | S 235 | 280,00 | | 2,23 |
| pl 12 | Plate 12x160 | 1 | S 235 | 280,00 | | 4,13 |
| pl 13 | Plate 20x160 | 1 | S 235 | 280,00 | | 6,80 |
| | | | | | | 267,79 |
| Position=KR 9 Number=1 Mass-Total=267,79(kg) | | | | | | |
| dp 6 | Q 140x140x10 | 1 | S 235 | 3205,94 | 38,851 | 124,55 |
| gp 7 | Q 140x140x10 | 1 | S 235 | 3324,65 | 38,851 | 129,17 |
| pl 7 | Plate 10x102 | 1 | S 235 | 204,37 | | 0,91 |
| pl 11 | Plate 10x120 | 1 | S 235 | 280,00 | | 2,23 |
| pl 12 | Plate 12x160 | 1 | S 235 | 280,00 | | 4,13 |
| pl 13 | Plate 20x160 | 1 | S 235 | 280,00 | | 6,80 |
| | | | | | | 267,79 |

***PROTUPOŽARNA I ANTIKOROZIVNA ZAŠTITA: PREMAZIVANJE***

ZAHTJEV TRAJNOSTI ANTIKOROZIVNE ZAŠTITE: HIGH DURABILITY ( prema HRN EN ISO 12944-1:1998)

AGRESIVNOST SREDINE: C1 - LOW (prema tablici 1 iz HRN EN ISO 12944-2:1998)

ZAHTJEV PROTUPOŽARNE OTPORNOSTI:

FAKULTET GRAĐEVINARSTVA, ARHITEKTURE I GEODEZIJE
KATEDRA ZA METALNE I DRVENE KONSTRUKCIJE
21000 SPLIT, MATICE HRVATSKE 15

SADRŽAJ LISTA:

# KLJUNOVI REŠETKI

M 1:20 1:10

GRAĐEVINA:
**Pristanišna zgrada zračne luke Dubrovnik Zgrada "ABC" - Sortirnica / Putnički terminal**

PROJEKT:
**Građenje južne nadstrešnice ispred zgrade "B" i zgrade "C"**

STUDENT:
**Mario Šarčević**

MENTOR:
**Prof.dr.sc. Bernardin Peroš**

FAZA PROJEKTA:
**IZVEDBENI PROJEKT**

SADRŽAJ:
**7.2. GRAĐEVINSKI NACRTI: KONSTRUKCIJA JUŽNE NADSTREŠNICE**

DATUM:
lipanj, 2015. god.


| | | | | | Unit (kg/m) | Total (kg) |
|---|---|---|---|---|---|---|
| Position=R 1 Number=1 Mass-Total=1240,70(kg) | | | | | | |
| dp 1 | Q 140x140x5 | 1 | S 235 | 1484,91 | 21,108 | 31,34 |
| dp 7 | Q 140x140x5 | 1 | S 235 | 18820,00 | 21,108 | 397,25 |
| gp 1 | Q 140x140x10 | 1 | S 235 | 143,78 | 38,851 | 5,59 |
| gp 2 | Q 140x140x5 | 1 | S 235 | 990,42 | 21,108 | 20,91 |
| gp 8 | Q 140x140x5 | 1 | S 235 | 9622,54 | 21,108 | 203,11 |
| gp 11 | Q 140x140x5 | 1 | S 235 | 11285,97 | 21,108 | 238,23 |
| i 1 | Q 90x90x4 | 1 | S 235 | 153,29 | 10,707 | 1,64 |
| i 4 | Q 90x90x4 | 1 | S 235 | 218,67 | 10,707 | 2,34 |
| i 7 | Q 90x90x4 | 1 | S 235 | 841,88 | 10,707 | 9,01 |
| i 10 | Q 90x90x4 | 1 | S 235 | 890,84 | 10,707 | 9,54 |
| i 13 | Q 90x90x4 | 1 | S 235 | 963,48 | 10,707 | 10,32 |
| i 16 | Q 90x90x4 | 1 | S 235 | 996,02 | 10,707 | 10,66 |
| i 19 | Q 90x90x4 | 1 | S 235 | 1085,08 | 10,707 | 11,62 |
| i 22 | Q 90x90x4 | 1 | S 235 | 1101,21 | 10,707 | 11,79 |
| i 25 | Q 90x90x4 | 1 | S 235 | 1204,41 | 10,707 | 12,90 |
| i 28 | Q 90x90x4 | 1 | S 235 | 1656,00 | 10,707 | 17,73 |
| i 31 | Q 90x90x4 | 1 | S 235 | 2339,18 | 10,707 | 25,05 |
| i 34 | Q 90x90x4 | 1 | S 235 | 2351,18 | 10,707 | 25,17 |
| i 37 | Q 90x90x4 | 1 | S 235 | 2424,42 | 10,707 | 25,96 |
| i 42 | Q 90x90x4 | 1 | S 235 | 2436,64 | 10,707 | 26,09 |
| i 43 | Q 90x90x4 | 1 | S 235 | 2442,22 | 10,707 | 26,15 |
| i 46 | Q 90x90x4 | 1 | S 235 | 2452,20 | 10,707 | 26,26 |
| i 49 | Q 90x90x4 | 1 | S 235 | 2552,82 | 10,707 | 27,33 |
| i 54 | Q 90x90x4 | 1 | S 235 | 2553,41 | 10,707 | 27,34 |
| pl 8 | Plate 12x160 | 2 | S 235 | 210,00 | | 6,15 |
| pl 11 | Plate 10x120 | 3 | S 235 | 280,00 | | 6,69 |
| pl 12 | Plate 12x160 | 1 | S 235 | 280,00 | | 4,13 |
| pl 13 | Plate 20x160 | 3 | S 235 | 280,00 | | 20,41 |
| | | | | | | 1240,70 |

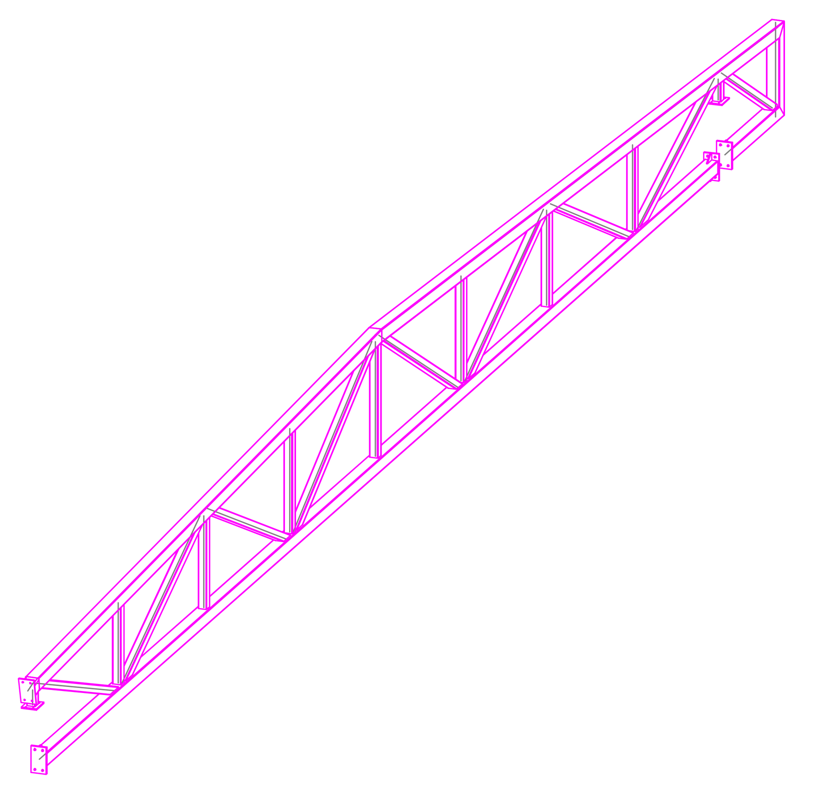
***PROTUPOŽARNA I ANTIKOROZIVNA ZAŠTITA: PREMAZIVANJE***

ZAHTJEV TRAJNOSTI ANTIKOROZIVNE ZAŠTITE: HIGH DURABILITY (prema HRN EN ISO 12944-1:1998)

AGRESIVNOST SREDINE: C1 - LOW (prema tablici 1 iz HRN EN ISO 12944-2:1998)

ZAHTJEV PROTUPOŽARNE OTPORNOSTI:

R 1 R Q 140x140x5 3D 1:50



FAKULTET GRAĐEVINARSTVA, ARHITEKTURE I GEODEZIJE
KATEDRA ZA METALNE I DRVENE KONSTRUKCIJE
21000 SPLIT, MATICE HRVATSKE 15

SADRŽAJ LISTA:

# REŠETKA - POZ R1

M 1:20 1:10

GRAĐEVINA:
**Pristanišna zgrada zračne luke Dubrovnik Zgrada "ABC" - Sortirnica / Putnički terminal**

PROJEKT:
**Građenje južne nadstrešnice ispred zgrade "B" i zgrade "C"**

STUDENT:
**Mario Šarčević**

MENTOR:
**Prof.dr.sc. Bernardin Peroš**

FAZA PROJEKTA:
**IZVEDBENI PROJEKT**

SADRŽAJ:
**7.2. GRAĐEVINSKI NACRTI: KONSTRUKCIJA JUŽNE NADSTREŠNICE**

DATUM:
lipanj, 2015. god.


| | | | | | Unit (kg/m) | Total (kg) |
|---|---|---|---|---|---|---|
| Position=R 3 Number=1 Mass-Total=1537,64(kg) | | | | | | |
| dp 2 | Q 140x140x8 | 1 | S 235 | 1484,91 | 32,019 | 47,55 |
| dp 8 | Q 140x140x8 | 1 | S 235 | 18820,00 | 32,019 | 602,60 |
| gp 1 | Q 140x140x10 | 1 | S 235 | 143,78 | 38,851 | 5,59 |
| gp 2 | Q 140x140x5 | 1 | S 235 | 990,42 | 21,108 | 20,91 |
| gp 8 | Q 140x140x5 | 1 | S 235 | 9622,54 | 21,108 | 203,11 |
| gp 11 | Q 140x140x5 | 1 | S 235 | 11285,97 | 21,108 | 238,23 |
| i 2 | Q 90x90x5 | 1 | S 235 | 153,29 | 13,052 | 2,00 |
| i 5 | Q 90x90x5 | 1 | S 235 | 218,67 | 13,052 | 2,85 |
| i 8 | Q 90x90x5 | 1 | S 235 | 841,88 | 13,052 | 10,99 |
| i 11 | Q 90x90x5 | 1 | S 235 | 890,84 | 13,052 | 11,63 |
| i 14 | Q 90x90x5 | 1 | S 235 | 963,48 | 13,052 | 12,58 |
| i 17 | Q 90x90x5 | 1 | S 235 | 996,02 | 13,052 | 13,00 |
| i 20 | Q 90x90x5 | 1 | S 235 | 1085,08 | 13,052 | 14,16 |
| i 23 | Q 90x90x5 | 1 | S 235 | 1101,21 | 13,052 | 14,37 |
| i 27 | Q 90x90x5 | 1 | S 235 | 1204,41 | 13,052 | 15,72 |
| i 29 | Q 90x90x5 | 1 | S 235 | 1656,00 | 13,052 | 21,61 |
| i 32 | Q 90x90x5 | 1 | S 235 | 2339,18 | 13,052 | 30,53 |
| i 35 | Q 90x90x5 | 1 | S 235 | 2351,18 | 13,052 | 30,69 |
| i 38 | Q 90x90x5 | 1 | S 235 | 2424,42 | 13,052 | 31,64 |
| i 40 | Q 90x90x5 | 1 | S 235 | 2436,64 | 13,052 | 31,80 |
| i 44 | Q 90x90x5 | 1 | S 235 | 2442,22 | 13,052 | 31,88 |
| i 47 | Q 90x90x5 | 1 | S 235 | 2452,20 | 13,052 | 32,01 |
| i 50 | Q 90x90x5 | 1 | S 235 | 2552,82 | 13,052 | 33,32 |
| i 52 | Q 90x90x5 | 1 | S 235 | 2553,41 | 13,052 | 33,33 |
| pl 1 | Plate 10x97 | 2 | S 235 | 185,28 | | 1,85 |
| pl 3 | Plate 10x90 | 2 | S 235 | 192,80 | | 1,79 |
| pl 4 | Plate 10x90 | 2 | S 235 | 193,47 | | 1,81 |
| pl 5 | Plate 10x90 | 2 | S 235 | 193,54 | | 1,82 |
| pl 7 | Plate 10x102 | 1 | S 235 | 204,37 | | 0,91 |
| pl 8 | Plate 12x160 | 2 | S 235 | 210,00 | | 6,15 |
| pl 11 | Plate 10x120 | 3 | S 235 | 280,00 | | 6,69 |
| pl 12 | Plate 12x160 | 1 | S 235 | 280,00 | | 4,13 |
| pl 13 | Plate 20x160 | 3 | S 235 | 280,00 | | 20,41 |
| | | | | | | 1537,64 |

**PROTUPOŽARNA I ANTIKOROZIVNA ZAŠTITA: PREMAZIVANJE**

ZAHTJEV TRAJNOSTI ANTIKOROZIVNE ZAŠTITE: HIGH DURABILITY ( prema HRN EN ISO 12944-1:1998)

AGRESIVNOST SREDINE: C1 - LOW (prema tablici 1 iz HRN EN ISO 12944-2:1998)

ZAHTJEV PROTUPOŽARNE OTPORNOSTI:

SADRŽAJ LISTA:

# REŠETKA - POZ R3

M 1:20 1:10

FAKULTET GRAĐEVINARSTVA, ARHITEKTURE I GEODEZIJE
KATEDRA ZA METALNE I DRVENE KONSTRUKCIJE
21000 SPLIT, MATICE HRVATSKE 15

GRAĐEVINA:
**Pristanišna zgrada zračne luke Dubrovnik Zgrada "ABC" - Sortirnica / Putnički terminal**

PROJEKT:
**Građenje južne nadstrešnice ispred zgrade "B" i zgrade "C"**

STUDENT:
**Mario Šarčević**

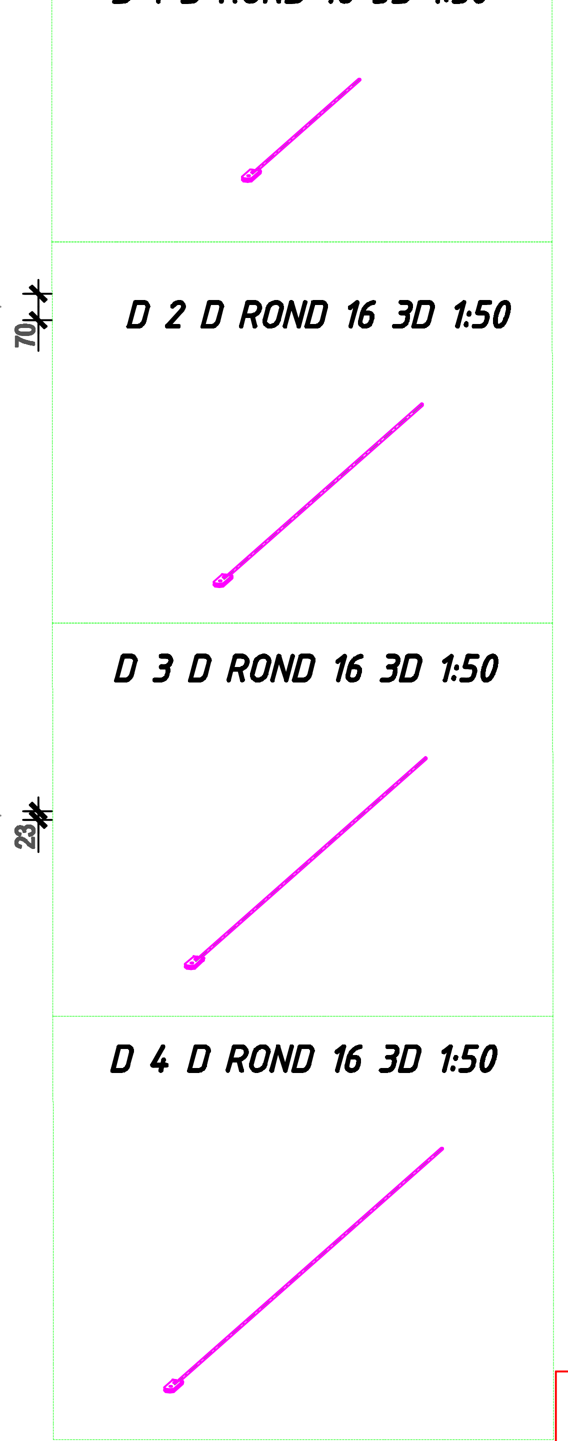
MENTOR:
**Prof.dr.sc. Bernardin Peroš**

FAZA PROJEKTA:
**IZVEDBENI PROJEKT**

SADRŽAJ:
**7.2. GRAĐEVINSKI NACRTI: KONSTRUKCIJA JUŽNE NADSTREŠNICE**

DATUM:
lipanj, 2015. god.

list **7.2.16.**


| Position | Section | Number | Grade | Length (mm) | Mass Unit (kg/m) | Mass Total (kg) |
|---|---|---|---|---|---|---|
| Position=D 1 Number=40 Mass-Total=169,44(kg) | | | | | | |
| d 1 | ROND 16 | 1 | S 235 | 2000,00 | 1,580 | 3,16 |
| pl 2 | Plate 70x23 | 1 | S 235 | 190,00 | | 1,08 |
| | | | | | | 4,24 |

| Position | Section | Number | Grade | Length (mm) | Mass Unit (kg/m) | Mass Total (kg) |
|---|---|---|---|---|---|---|
| Position=D 2 Number=8 Mass-Total=55,38(kg) | | | | | | |
| d 2 | ROND 16 | 1 | S 235 | 3700,00 | 1,580 | 5,85 |
| pl 2 | Plate 70x23 | 1 | S 235 | 190,00 | | 1,08 |
| | | | | | | 6,92 |

| Position | Section | Number | Grade | Length (mm) | Mass Unit (kg/m) | Mass Total (kg) |
|---|---|---|---|---|---|---|
| Position=D 3 Number=24 Mass-Total=188,88(kg) | | | | | | |
| d 3 | ROND 16 | 1 | S 235 | 4300,00 | 1,580 | 6,79 |
| pl 2 | Plate 70x23 | 1 | S 235 | 190,00 | | 1,08 |
| | | | | | | 7,87 |

| Position | Section | Number | Grade | Length (mm) | Mass Unit (kg/m) | Mass Total (kg) |
|---|---|---|---|---|---|---|
| Position=D 4 Number=8 Mass-Total=71,81(kg) | | | | | | |
| d 4 | ROND 16 | 1 | S 235 | 5000,00 | 1,580 | 7,90 |
| pl 2 | Plate 70x23 | 1 | S 235 | 190,00 | | 1,08 |
| | | | | | | 8,98 |

**PROTUPOŽARNA I ANTIKOROZIVNA ZAŠTITA: PREMAZIVANJE**

ZAHTJEV TRAJNOSTI ANTIKOROZIVNE ZAŠTITE: HIGH DURABILITY ( prema HRN EN ISO 12944-1:1998)

AGRESIVNOST SREDINE: C1 - LOW (prema tablici 1 iz HRN EN ISO 12944-2:1998)

ZAHTJEV PROTUPOŽARNE OTPORNOSTI:


FAKULTET GRAĐEVINARSTVA, ARHITEKTURE I GEODEZIJE
KATEDRA ZA METALNE I DRVENE KONSTRUKCIJE
21000 SPLIT, MATICE HRVATSKE 15


SADRŽAJ LISTA:

# ZATEGE

M 1:20 1:10

GRAĐEVINA:
**Pristanišna zgrada zračne luke Dubrovnik Zgrada "ABC" - Sortirnica / Putnički terminal**

PROJEKT:
**Građenje južne nadstrešnice ispred zgrade "B" i zgrade "C"**

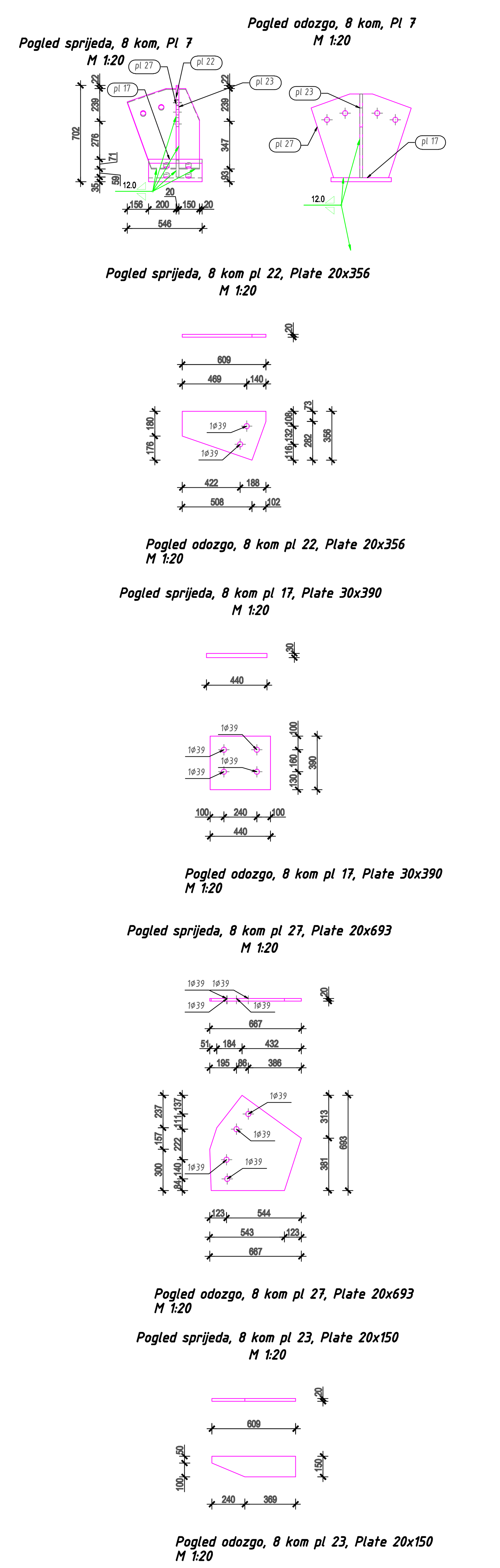

STUDENT:
**Mario Šarčević**

MENTOR:
**Prof.dr.sc. Bernardin Peroš**


FAZA PROJEKTA:
**IZVEDBENI PROJEKT**

SADRŽAJ:
**7.2. GRAĐEVINSKI NACRTI: KONSTRUKCIJA JUŽNE NADSTREŠNICE**

DATUM:
lipanj, 2015. god.



Pogled sprijeda, 8 kom, Pl 7
M 1:20

Pogled odozgo, 8 kom, Pl 7
M 1:20

Pogled sprijeda, 8 kom pl 22, Plate 20x356
M 1:20

Pogled odozgo, 8 kom pl 22, Plate 20x356
M 1:20

Pogled sprijeda, 8 kom pl 17, Plate 30x390
M 1:20

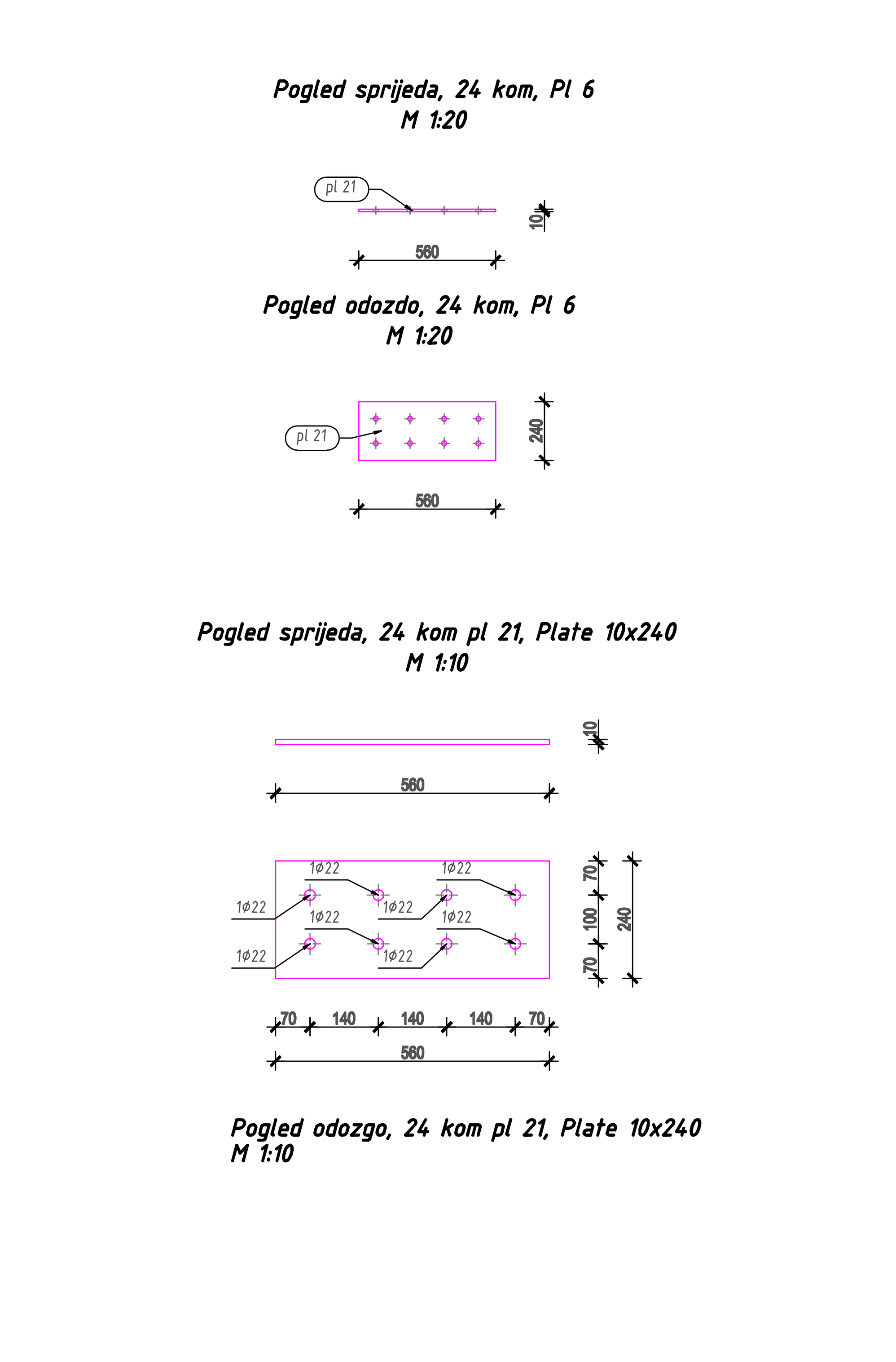
Pogled odozgo, 8 kom pl 17, Plate 30x390
M 1:20

Pogled sprijeda, 8 kom pl 27, Plate 20x693
M 1:20

Pogled odozgo, 8 kom pl 27, Plate 20x693
M 1:20

Pogled sprijeda, 8 kom pl 23, Plate 20x150
M 1:20

Pogled odozgo, 8 kom pl 23, Plate 20x150
M 1:20

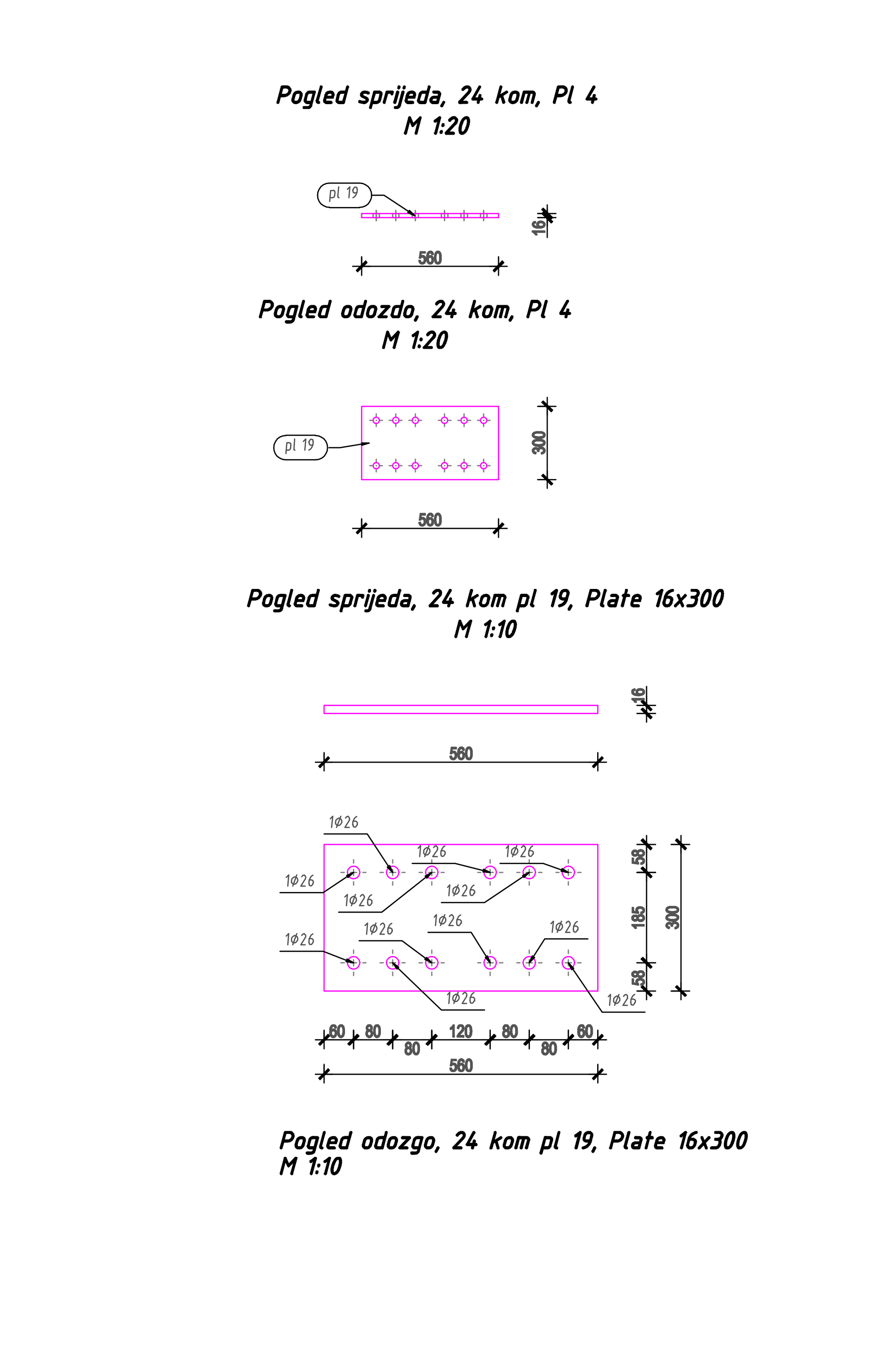


Pogled sprijeda, 24 kom, Pl 6
M 1:20

Pogled odozdo, 24 kom, Pl 6
M 1:20

Pogled sprijeda, 24 kom pl 21, Plate 10x240
M 1:10

Pogled odozgo, 24 kom pl 21, Plate 10x240
M 1:10

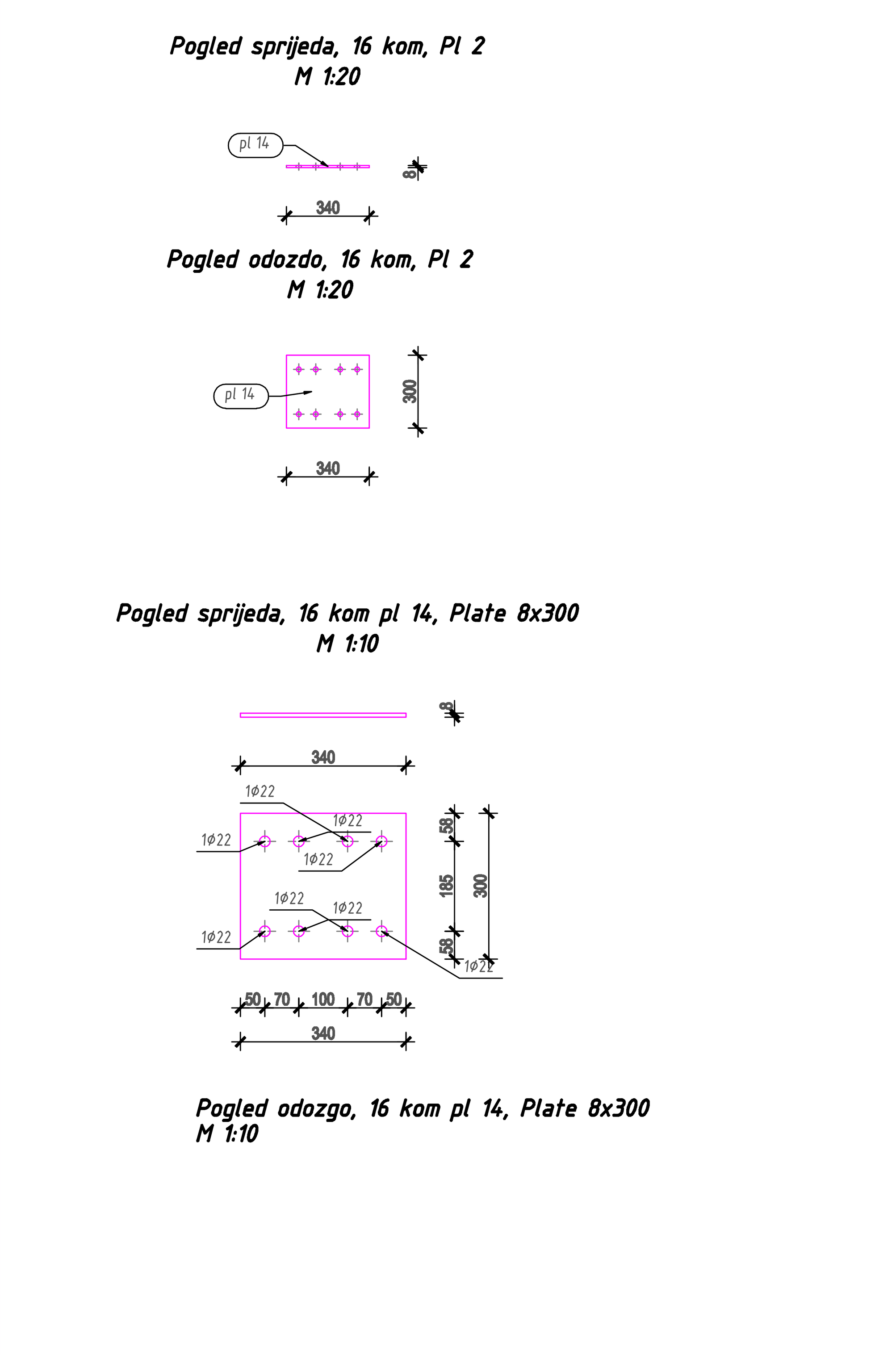


Pogled sprijeda, 24 kom, Pl 4
M 1:20

Pogled odozdo, 24 kom, Pl 4
M 1:20

Pogled sprijeda, 24 kom pl 19, Plate 16x300
M 1:10

Pogled odozgo, 24 kom pl 19, Plate 16x300
M 1:10

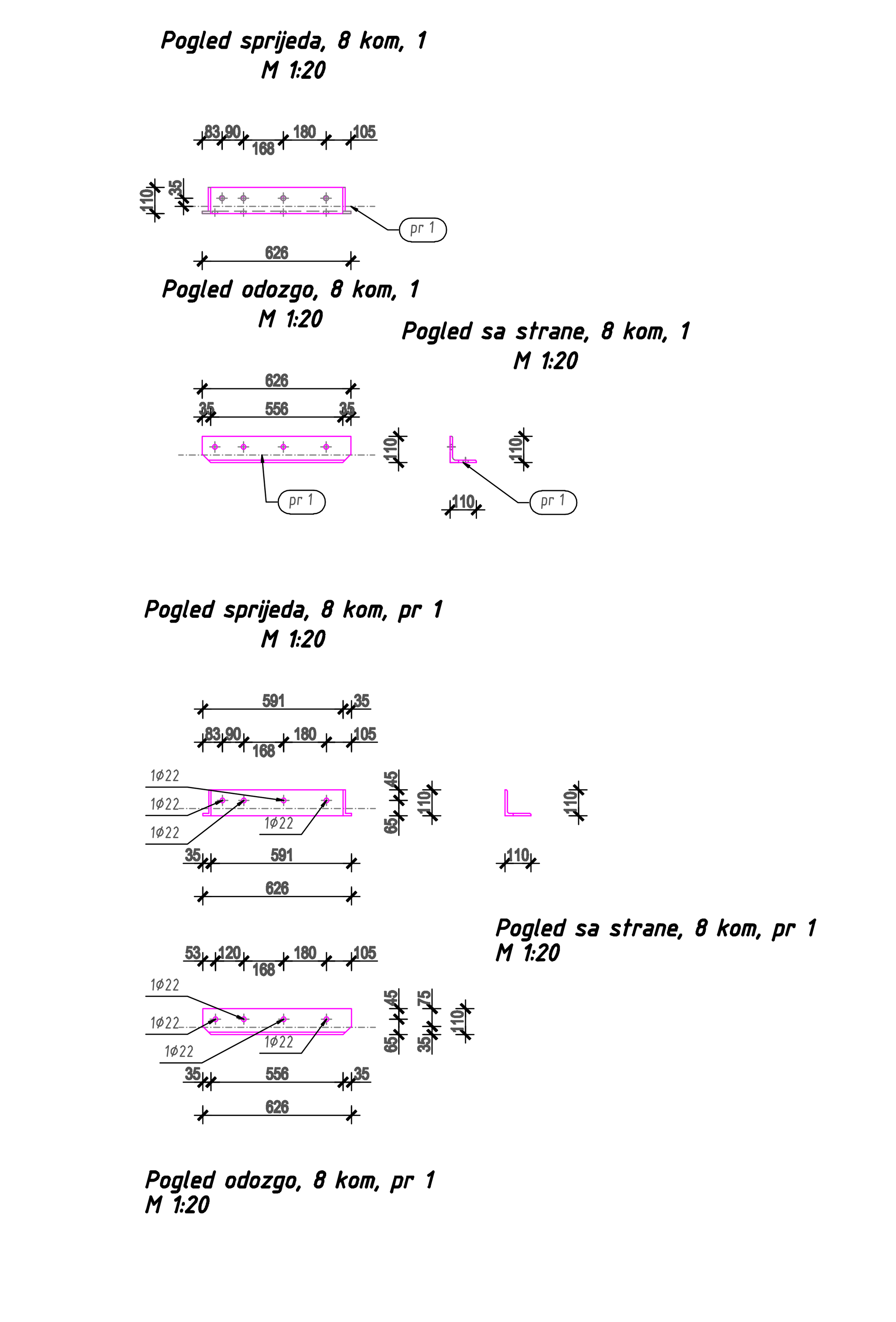


Pogled sprijeda, 16 kom, Pl 2
M 1:20

Pogled odozdo, 16 kom, Pl 2
M 1:20

Pogled sprijeda, 16 kom pl 14, Plate 8x300
M 1:10

Pogled odozgo, 16 kom pl 14, Plate 8x300
M 1:10



Pogled sprijeda, 8 kom, 1
M 1:20

Pogled odozgo, 8 kom, 1
M 1:20

Pogled sa strane, 8 kom, 1
M 1:20

Pogled sprijeda, 8 kom, pr 1
M 1:20

Pogled sa strane, 8 kom, pr 1
M 1:20

Pogled odozgo, 8 kom, pr 1
M 1:20

| Position | Section | Number | Grade | Length (mm) | Mass | |
|---|---|---|---|---|---|---|
| | | | | | Unit (kg/m) | Total (kg) |
| Position=Pl 1 Number=16 Mass-Total=29,03(kg) | | | | | | |
| pl 6 | Plate 6x200 | 1 | S 235 | 200,00 | | 1,81 |
| | | | | | | 1,81 |

| Position | Section | Number | Grade | Length (mm) | Mass | |
|---|---|---|---|---|---|---|
| | | | | | Unit (kg/m) | Total (kg) |
| Position=Pl 2 Number=16 Mass-Total=99,55(kg) | | | | | | |
| pl 14 | Plate 8x300 | 1 | S 235 | 340,00 | | 6,22 |
| | | | | | | 6,22 |

| Position | Section | Number | Grade | Length (mm) | Mass | |
|---|---|---|---|---|---|---|
| | | | | | Unit (kg/m) | Total (kg) |
| Position=Pl 3 Number=32 Mass-Total=75,62(kg) | | | | | | |
| pl 15 | Plate 8x115 | 1 | S 235 | 340,00 | | 2,36 |
| | | | | | | 2,36 |

| Position | Section | Number | Grade | Length (mm) | Mass | |
|---|---|---|---|---|---|---|
| | | | | | Unit (kg/m) | Total (kg) |
| Position=Pl 4 Number=24 Mass-Total=487,88(kg) | | | | | | |
| pl 19 | Plate 16x300 | 1 | S 235 | 560,00 | | 20,33 |
| | | | | | | 20,33 |

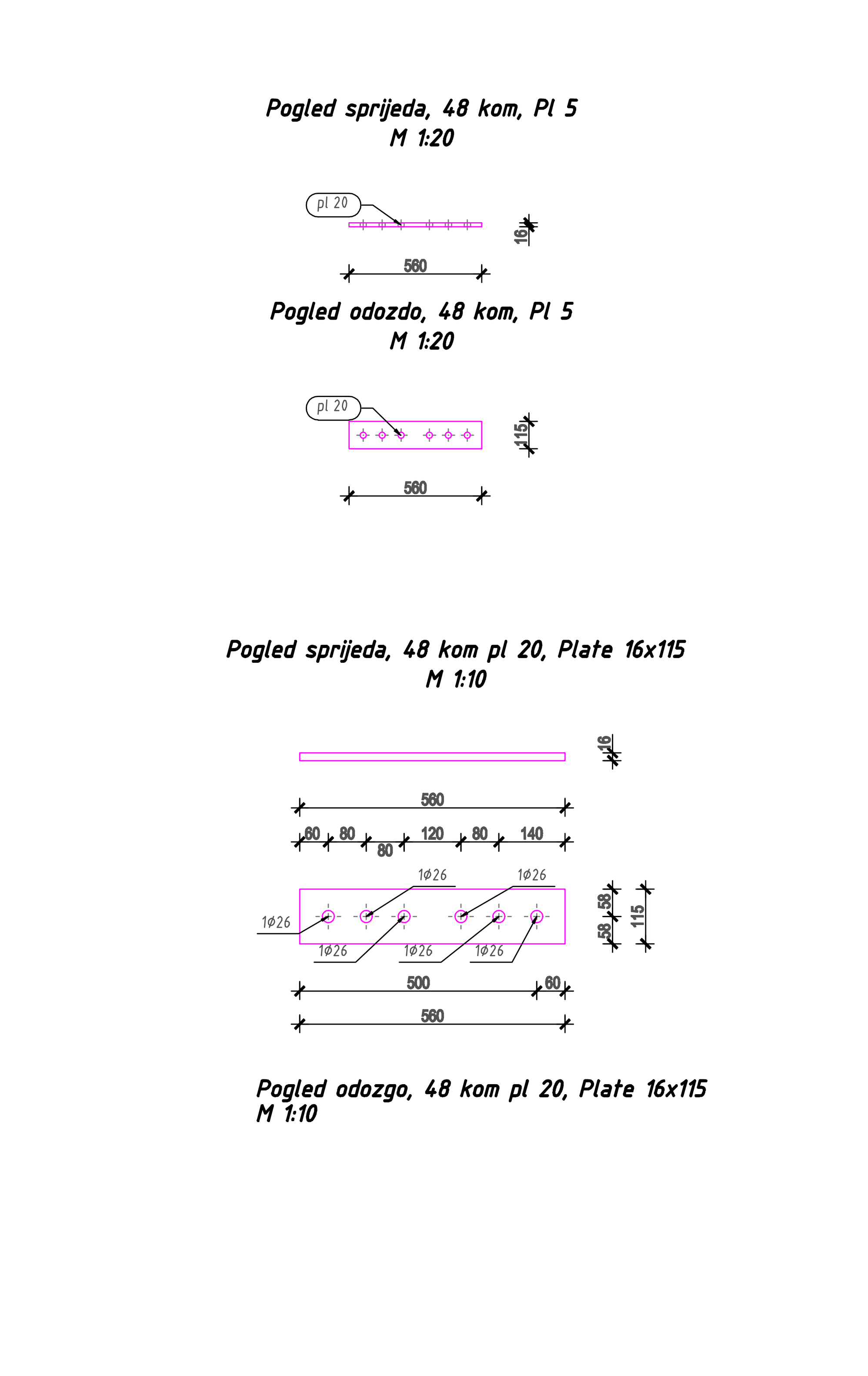
| Position | Section | Number | Grade | Length (mm) | Mass | |
|---|---|---|---|---|---|---|
| | | | | | Unit (kg/m) | Total (kg) |
| Position=Pl 5 Number=48 Mass-Total=369,67(kg) | | | | | | |
| pl 20 | Plate 16x115 | 1 | S 235 | 560,00 | | 7,70 |
| | | | | | | 7,70 |

| Position | Section | Number | Grade | Length (mm) | Mass | |
|---|---|---|---|---|---|---|
| | | | | | Unit (kg/m) | Total (kg) |
| Position=Pl 6 Number=24 Mass-Total=247,72(kg) | | | | | | |
| pl 21 | Plate 10x240 | 1 | S 235 | 560,00 | | 10,32 |
| | | | | | | 10,32 |

| Position | Section | Number | Grade | Length (mm) | Mass | |
|---|---|---|---|---|---|---|
| | | | | | Unit (kg/m) | Total (kg) |
| Position=Pl 7 Number=8 Mass-Total=1021,09(kg) | | | | | | |
| pl 17 | Plate 30x390 | 1 | S 235 | 440,00 | | 39,33 |
| pl 22 | Plate 20x356 | 1 | S 235 | 609,47 | | 24,41 |
| pl 23 | Plate 20x150 | 1 | S 235 | 609,47 | | 12,47 |
| pl 27 | Plate 20x693 | 1 | S 235 | 666,84 | | 51,42 |
| | | | | | | 127,64 |

| Position | Section | Number | Grade | Length (mm) | Mass | |
|---|---|---|---|---|---|---|
| | | | | | Unit (kg/m) | Total (kg) |
| Position=1 Number=8 Mass-Total=83,13(kg) | | | | | | |
| pr 1 | L 110x110x10 | 1 | S 235 | 626,00 | 16,600 | 10,39 |
| | | | | | | 10,39 |

| Position | Section | Number | Grade | Length (mm) | Mass | |
|---|---|---|---|---|---|---|
| | | | | | Unit (kg/m) | Total (kg) |
| Position=2 Number=8 Mass-Total=83,13(kg) | | | | | | |
| pr 2 | L 110x110x10 | 1 | S 235 | 626,00 | 16,600 | 10,39 |
| | | | | | | 10,39 |

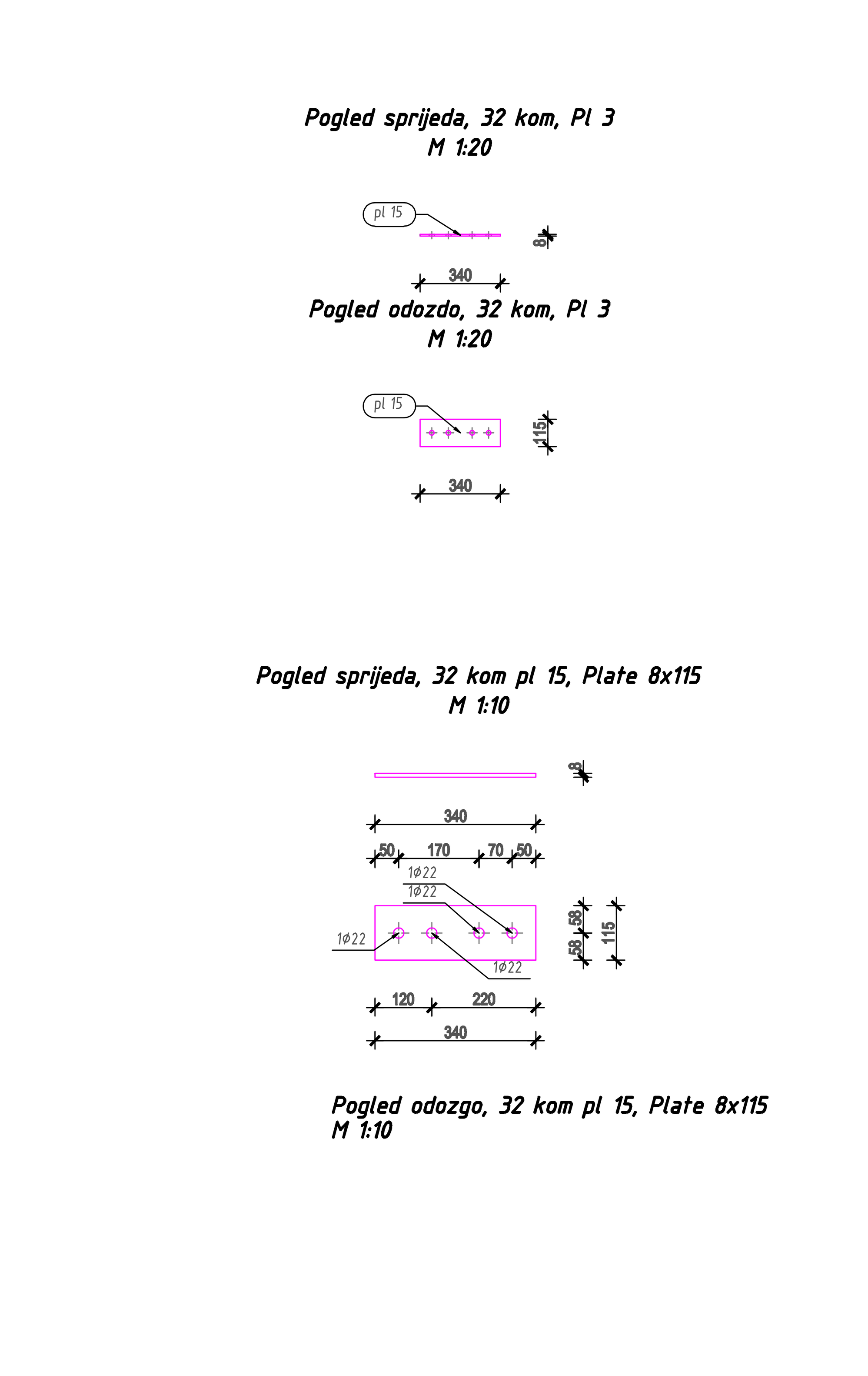


Pogled sprijeda, 48 kom, Pl 5
M 1:20

Pogled odozdo, 48 kom, Pl 5
M 1:20

Pogled sprijeda, 48 kom pl 20, Plate 16x115
M 1:10

Pogled odozgo, 48 kom pl 20, Plate 16x115
M 1:10

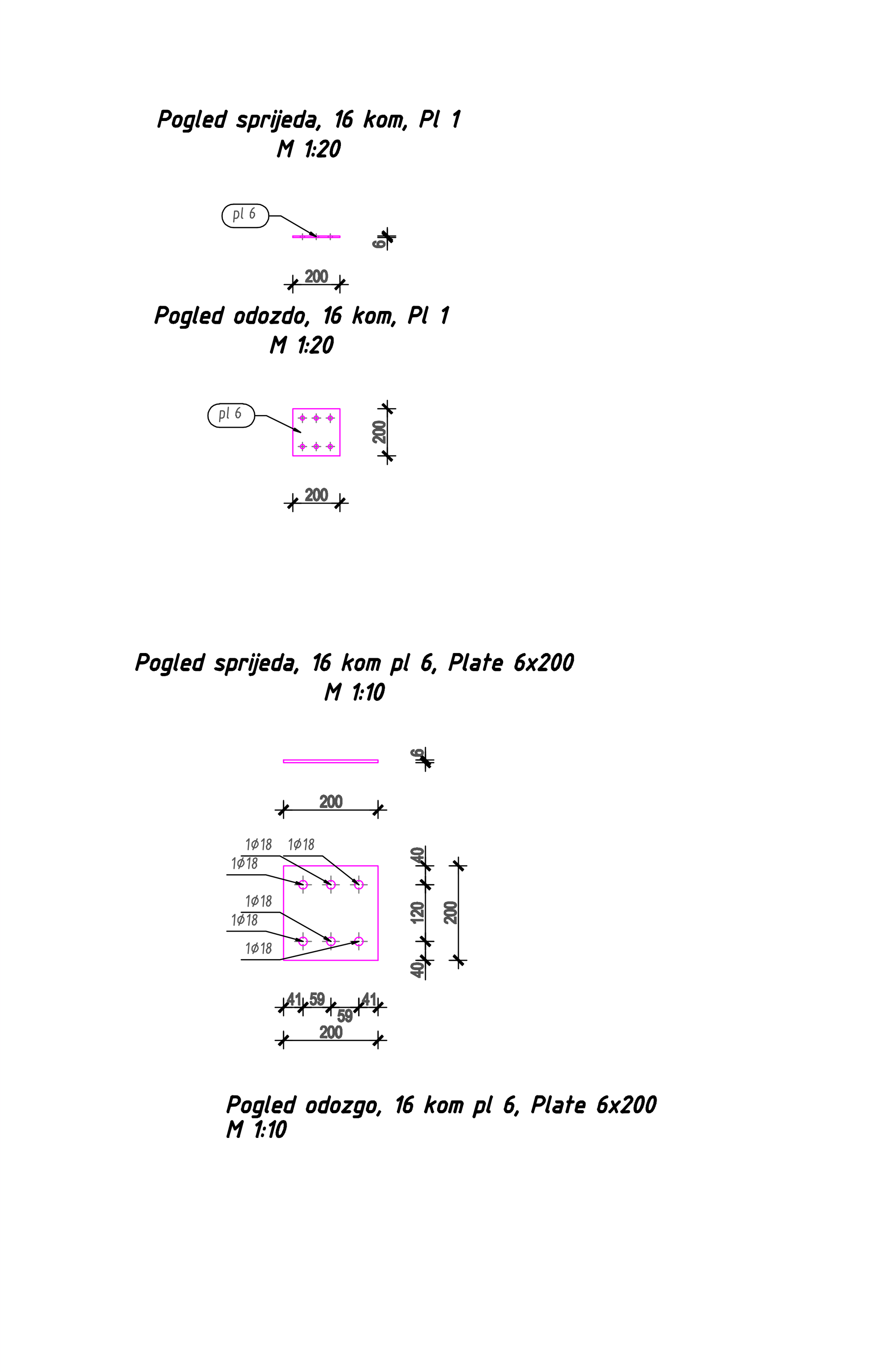


Pogled sprijeda, 32 kom, Pl 3
M 1:20

Pogled odozdo, 32 kom, Pl 3
M 1:20

Pogled sprijeda, 32 kom pl 15, Plate 8x115
M 1:10

Pogled odozgo, 32 kom pl 15, Plate 8x115
M 1:10

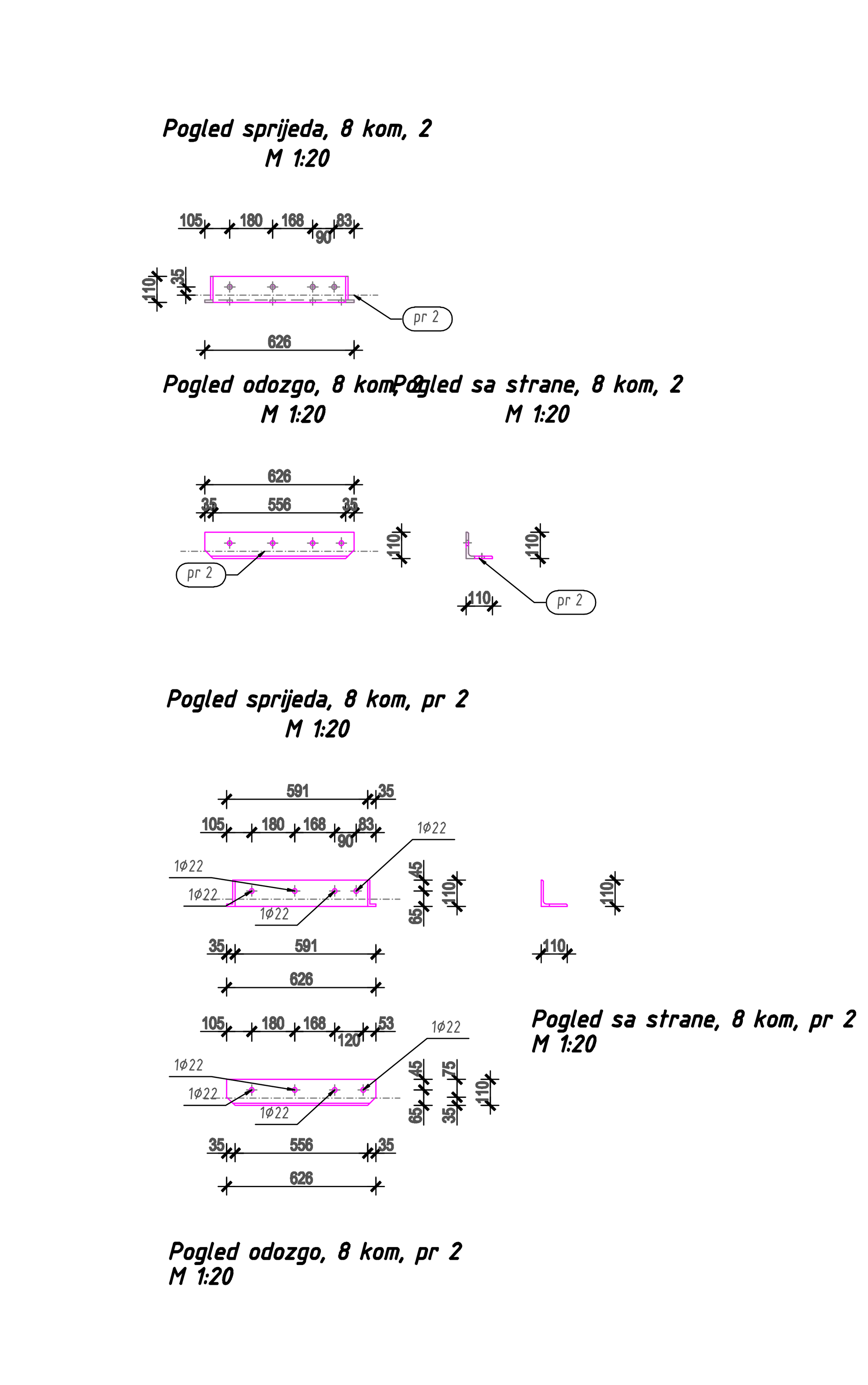


Pogled sprijeda, 16 kom, Pl 1
M 1:20

Pogled odozdo, 16 kom, Pl 1
M 1:20

Pogled sprijeda, 16 kom pl 6, Plate 6x200
M 1:10

Pogled odozgo, 16 kom pl 6, Plate 6x200
M 1:10



Pogled sprijeda, 8 kom, 2
M 1:20

Pogled odozgo, 8 kom, 2
M 1:20

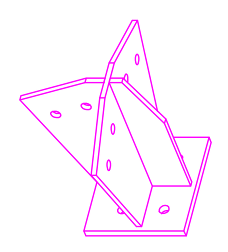
Pogled sa strane, 8 kom, 2
M 1:20

Pogled sprijeda, 8 kom, pr 2
M 1:20

Pogled sa strane, 8 kom, pr 2
M 1:20

Pogled odozgo, 8 kom, pr 2
M 1:20

Pl 7 Plate 20x693 3D 1:20



**PROTUPOŽARNA I ANTIKOROZIVNA ZAŠTITA: PREMAZIVANJE**

ZAHTJEV TRAJNOSTI ANTIKOROZIVNE ZAŠTITE: HIGH DURABILITY ( prema HRN EN ISO 12944-1:1998)

AGRESIVNOST SREDINE: C1 - LOW (prema tablici 1 iz HRN EN ISO 12944-2:1998)

ZAHTJEV PROTUPOŽARNE OTPORNOSTI:

FAKULTET GRAĐEVINARSTVA, ARHITEKTURE I GEODEZIJE
KATEDRA ZA METALNE I DRVENE KONSTRUKCIJE
21000 SPLIT, MATICE HRVATSKE 15

SADRŽAJ LISTA:

# PLOČICE

M 1:20 1:10

GRAĐEVINA:
**Pristanišna zgrada zračne luke Dubrovnik**
**Zgrada "ABC" - Sortirnica / Putnički terminal**

PROJEKT:
**Građenje južne nadstrešnice ispred zgrade "B" i zgrade "C"**

STUDENT:
**Mario Šarčević**

MENTOR:
**Prof.dr.sc. Bernardin Peroš**

FAZA PROJEKTA:
**IZVEDBENI PROJEKT**

SADRŽAJ:
**7.2. GRAĐEVINSKI NACRTI: KONSTRUKCIJA JUŽNE NADSTREŠNICE**

DATUM:
lipanj, 2015. god.

list **7.2.18.**